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SOME DIFFICULTIES OF HEAVY ELECTRIC TRACTION.

It is probable that the greatest difficulty in the way of heavy electric traction is the conservative tendency of those who have to pay for railway motive power. Putting aside the extravagant claims of newspapers and the like, and examining the relative advantages of steam and electric traction as applied to main line railways now worked by steam, it is not hard to see just where each has its field and each its peculiar fitness. To inveigh against the advance of electricity into this new field is utterly useless. Its progress is accelerating, and it cannot be long before its utilization will be common.

The interesting paper on this subject by Dr. Louis Bell, which is concluded in this issue, is a statement of the case of the steam locomotive, and an admirable defense of its reasons for continued existence. The trouble is that the locomotive needs no such defense. It seems reasonably certain that, for long distance haulage, especially in districts where the travel is relatively small, the locomotive will not be displaced by the motor. The case is not very different from that which presented itself to the engineering profession some seventy years ago, when the locomotive was the recipient of varied abuse. It has not yet entirely displaced the horse, but the stage coach is a thing of the past. So it must be with the motor and the locomotive. Nobody expects to see the locomotive entirely displaced, even on railway systems of but moderate length, but it is surely not unreasonable to think that it will not be many years into the next century before a locomotive-hauled suburban train will be looked upon very much as an omnibus is to-day—a relic of a barbarous past.

To the extent that he argues against the equipment of many miles of sparsely traveled railroad with an electric traction system Dr. Bell wastes his logic, since nobody proposes any such equipment now. What may be done in the future after alternating motors are further perfected it is hard to say; but certainly there is no necessity for a homogeneous equipment of an entire railway system. Why not the locomotive for long hauls and the motor for short? Many railroads now operate horse-drawn cabs from their termini, without thinking of replacing their horses by locomotives. The trouble is very much like that which was encountered by the early steam railway engineers—the difficulty of making people give up preconceived notions as to what travel should be. To this day the semblance of the stage coach can be traced in the British railway car. Shall we allow the fashion of the steam train to trouble our conceptions of electric motor travel?

It must never be forgotten by those who wish to further the interests of electricity on steam railways that there is no earthly necessity for the electric equipment to be in the least like the present steam equipment. It is just here where conservatism may step in, and by blinding us to the real situation make an apparently more difficult one. If anybody wants to replace locomotives with electric motors for an entire railway system he will find a much-to-be-heeded warning in Dr. Bell's paper, but if it is simply desired to use electricity where and how it may best be used for carrying passengers and freights over existing routes, that is a different matter.

THE GAS ENGINE IN CENTRAL STATION PRACTICE.

In many applications of small powers, especially where space is a consideration of importance, the gas or vapor engine is fast displacing the steam engine, and but for the fact that such installations are for the most part in cities, where there is competition from the far more convenient electric motor, this displacement would unquestionably be more evident. Enjoying as it does the great advantages of compactness, convenience, high efficiency and great economy of operation as compared with steam engines, in the smaller sizes at least, it has already shown evidences of its excellence for the driving of small electric generating plants. The question naturally arises, why not for large ones as well?

This seems, in the present state of the art, somewhat difficult to answer. If the same relative economy and efficiency, as compared with steam engines, could be shown by explosion motors of large sizes, or if the great difficulties in the way of constructing these could be in some way avoided, there would be but one answer possible. As the size of steam engine units and the volume of steam handled in them increases compounding is resorted to, and this well understood and elaborately worked out method shows a very great gain in economy and efficiency until condensation in the cylinders or complexity of the apparatus becomes a bar to its further extension. So far compounding has played but a small part in the development of gas engines, and it can hardly be predicted as yet what results may be achieved by its use. The lack of experience with compound machines, however, is not the main difficulty in the way of the development of large internal-combustion engines. There are troubles inherent in the engines themselves of a very serious character. Perhaps the most evident of these is the practical impossibility of making a homogeneous mixture of gas and air in a large cylinder in the short time allowable for this purpose, the necessity of keeping the cylinder walls far cooler than the working temperature of the exploding gases, and the great difficulty of clearing the cylinder and the necessarily large clearance spaces in it of the products of combustion.

If the attempt is made to obtain a better admixture and more gradual combustion by the use of Otto cycle engines, that is, engines in which ignition is made only once in two revolutions, the necessity for a multiplicity of cylinders arises. These increase the complexity of the machine, until a limit is soon reached beyond which their multiplication is no longer desirable. The working temperature of the ignited gas is very high, being that of flame or even higher if the initial compression is great. This mass of glowing gases is confined in a cylinder of conducting metal, which must in most cases be water jacketed to keep it from becoming red hot. The loss due to this cause is considerable. In cylinders of large diameter the central parts of the piston become very hot in a short time, in fact so hot as to explode the incoming gases if some precaution against this is not taken.

There is, necessarily, in a motor of this class a large cylinder clearance or "explosion chamber." This becomes filled after each ignition with the products of combustion, which, mixing with the gases for the next stroke, dilute them, and reduce their effective working capacity by abstracting heat from the exploding mixture. These causes, together with the difficulties involved in the handling of the great and sudden explosion pressures, seem to be the principal reasons for the non-appearance up to this time of the gas engine as a formidable competitor to the steam engine in central station work on a large scale.

None of the difficulties mentioned above seem to be of the sort that cannot be conquered. It may require radical departures from present methods before the gas engine takes the place that the laws of thermo-dynamics indicate as its own. Whatever its present crudities and however great the labor involved in the elaboration of more perfect forms, it remains a fact that the possibilities of this type of motor are far greater than those of the steam engine with a separate boiler, and that its perfected form must far surpass in both efficiency and economy any other heat motors at present known.

COMPARISONS OF AMERICAN AND EUROPEAN PRACTICE.

In the rapid development of the electrical industry now taking place it is interesting to note the differences between the principles and details of electrical work in the different countries. The development is so rapid that continents even as closely interconnected as are North America and Europe at present do not find time for a sufficiently close comparison of notes to make the most of each other's innovations.

In another column will be found a contribution by Mr. A. E. Levin on the electrical machinery manufactured by Brown, Boveri & Co., of Baden, Switzerland. Many differences will be noted between the machinery there described and illustrated and that accepted as good practice in this country. There has been in the past a considerable difference in the demand for machinery between the two countries. In America there has been a stronger desire for the lowering of the first cost of machinery, while in Europe greater attention has been paid to the reduction of depreciation, maintenance and running expenses. This difference is natural, and due largely to the higher rates of interest paid in America and the desire of the American investor to get rich quickly, as opposed to the desire of the European to obtain safe investments for a long term of years. American investors are, however, becoming less impatient, and industrial practices are constantly approaching similar work in Europe.

Messrs. Brown, Boveri & Co. have given special attention to alternating current machinery, and it is noticeable that all the motors in their works are alternating motors, also that they have equipped railway lines, including one cogwheel mountain road, with electric traction apparatus in which no direct currents are used. This bold application to the most difficult problems certainly speaks well for the adaptability of the alternating motor. The combination of the exciter on an extension of the shaft of the alternating generator is ingenious, and not used in this country in exactly the same form, that is, with no outboard bearing beyond the exciter, the armature of which is overhung, and with the commutator placed inside and out of reach of blows from passing objects. The inductor type machine is also interesting, owing to the fact that although there is no reversal of the direction of the lines of force in the armature core plates, still the aggregate number included by any loop of the armature winding reverses from a maximum in one direction to a maximum in the other. The end connections are also reduced to one-half of those required on inductor types of the same number of poles as built in this country, and this reduction is effected on the inside connections, which are the most difficult to reach and repair. The departure made from the custom of supporting the stationary frame of direct-coupled machines on a bed plate or concrete foundation is also interesting. The fixed part of the machine is simply mounted on spiders similar to fly-wheel frames, and centered on rings cast on the engine bearings. This obviously maintains the alignment of the frame of the generator concentric with the rotating part much more accurately than does the former construction.

The Electrical Machinery of Brown, Boveri & Co.—I.

BY A. E. LEVIN.

In the autumn of 1891, Mr. C. E. L. Brown, already well known as the manager of the electrical department of the Oerlikon Engineering Works, severed his connection with that firm, and joined his colleague, Mr. Boveri, in founding the firm of Brown, Boveri & Co., of Baden.

The works were not available for the manufacture of machinery till the spring of the next year, so that the actual active existence of the firm may be said to date from less than six years ago. Yet the amount of machinery turned out would well compare with that of many old-established houses. Up to the beginning of December, 1897, the total number of dynamos and motors built, or on order, was no less than 3600, while the power of these machines aggregated 140,000 horse-power. This does not include the transformers built by the firm, which number about 2000.

When first started, the firm acquired a piece of ground adjoining the railway in Baden, and having an area of 36,000 square yards. On this were built the offices, the pattern shops, stores and the large main building, which has been successively enlarged till it is now one of the largest workshops under one roof to be found in the country. Further space being required for extensions, another piece of land, having an area of 38,000 square yards, has been acquired on the further side of the Brugger Strasse, but connected with the main shops by two lines of rails; this ground is already partly occupied by the new foundry. The works give employment to over 1000 men, while about 200 are employed in the branch works in Frankfort-on-Main.

FIG. 2.—STANDARD TYPE ALTERNATOR, 100 TO 500 HORSE-POWER.

The main shops cover an area of 12,000 square yards, and are divided into fourteen bays, of which four are spanned by electric traveling cranes of various lifting capacities from 10 to 30 tons. These cranes are all driven electrically, each movement being controlled by a separate three-phase motor. The motor for lifting and lowering the load and that for the transverse motion of the crab are placed on the latter, while the motor which produces the longitudinal motion of the whole crane is mounted on a bracket in the middle of one of the main girders. These four bays are devoted to the tooling and erection of the heavier machinery, and are provided with the most modern machine tools, among which may be mentioned two fine lathes, taking in work up to 27 feet in diameter. The other bays are spanned by hand cranes for 3 tons, and contain the lighter machine tools, as well as the fitting benches, etc.

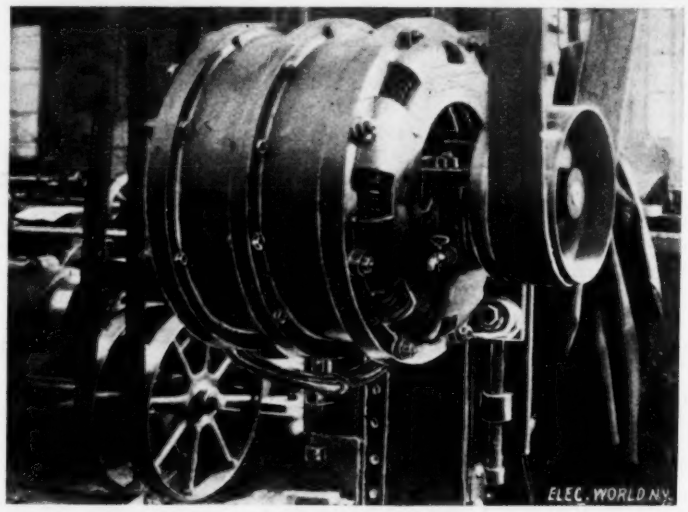


FIG. 1.—WORKSHOP MOTORS.

The whole works are driven electrically, the current being obtained from a power house on the River Limmat, about a mile below the works. The same station supplies current for power and light in the town of Baden, the current being transmitted at a tension of 1000 volts, two-phase. As the water-power available is now completely used up, a steam reserve plant has been put down to help the hydraulic power station during periods of low water. For the works motors the current is transformed down to a tension of 120 volts. These motors are placed on columns under the shafts which they drive. Fig. 1 shows two such motors, one being fitted to each line of shafting, except in some cases where the latter is lightly loaded, when two shafts are connected together by a belt. The heavier machine tools are provided with separate motors to facilitate overtime work, and for convenience in placing the tools independently of the direction of the shafting.

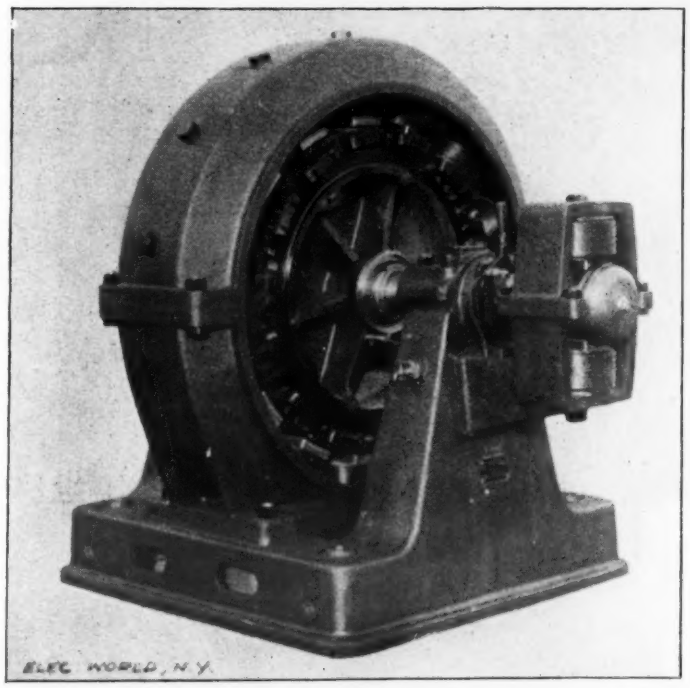


FIG. 3.—STANDARD TYPE ALTERNATOR UP TO 100 HORSE-POWER.

Half of one of the main bays is devoted to the testing of machinery. This is fitted with suitable bed-plates for receiving the machine to be tested, and with a 25-hp motor, driving two cone pulleys for obtaining any graduation of speed which may be desired. A 100-hp motor is used for driving the larger machines under test, while two alternators with special winding, allowing of various connections so as to obtain any different voltage or frequency desired, are employed in motor testing. A special department is devoted to high-tension tests. Here are placed transformers immersed in oil baths, capable of giving tensions up to 60,000 volts alternating, while, by regulating the primary tension, any desired lower voltage may be obtained. By means of these transformers are tested all insulating tubes employed in the winding of high-tension generators, thus insuring that no faulty tube can be used. As most of the large machines are built directly on the fly-wheels of engines, they cannot be tested under full load in the works, but they are submitted to careful insulation tests

before being sent out, and are subsequently fully tested on being erected.

As is well known, the firm has made a specialty of alternate current work, indeed about 85 per cent. of the machinery turned out is for single or multiphase alternate current.

One of the most usual forms of alternator is represented in Fig. 2. These machines are built in different sizes for various speeds and powers from 100 to 500 horse-power. As will be seen, the armature is fixed, and surrounds the rotating field magnets. The armatures are all tunnel-wound, the winding, in the case of low-tension machines, such as those destined for power distribution in factories, being formed of solid copper bars, bent to shape on forms, and after being placed in the armature, soldered together. The end connections are arranged on a cylindrical surface, in the manner first employed by Mr. C. E. L. Brown six years ago. This arrangement permits of easy repairs should such become necessary, and forms an excellent winding from the mechanical point of view. In the case of high-tension machines the winding is of wire or cable, passed through highly insulating tubes, with which the holes are lined. As explained above, the tubes are all tested beforehand to at least double the tension for which the machine is designed.

The magnet wheel consists of a steel casting, having half the poles cast in one piece with it. Between these are suitable facings, to which the remaining poles of wrought iron are bolted. It is these latter only that are wound, the cast steel poles being so shaped as to partly embrace the magnetizing spools. This arrangement is employed in order to be able to use round magnets, as in nearly all the machines built by the firm. For the windings of the spools on such magnet wheels, as also for the high-tension windings of transformers, paper-covered wire is usually employed.

The bearings of these alternators are always of white metal, automatic ring lubrication being employed. The shafts are usually hardened in the necks and afterwards ground true. In most cases the exciters are mounted on the generators themselves, the armature being placed on the overhanging shaft, and it will be noticed that the commutator is turned inside, towards the main bearing, thus doing away with unsightly rockers and brushholders outside. It is usual to regulate by varying the tension of the exciter only, the fall of tension between full and no load being only about 4 to 5 per cent. when the load is inductionless, though it is about three to four times as much when loaded on motors. Multiphase generators are usually built with sufficiently powerful fields to work at full load on a circuit having a power factor of 75 per cent. The smaller sizes of alternators are usually built with rotating armature, as shown on Fig. 3. It will be seen that the winding of the armature is somewhat similar to that of the fixed type. The field magnets are of wrought iron, fixed round a cast-iron shell.

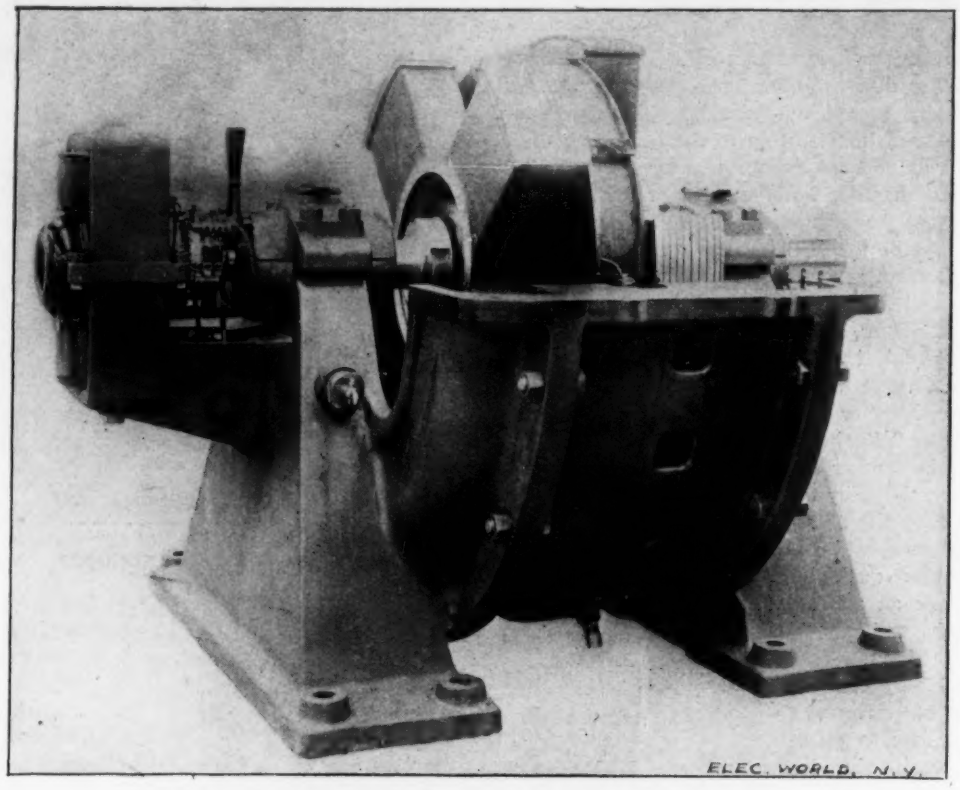


Fig. 4.—Inductor Alternator.

For certain special cases the firm has built machines of the "inductor" type, without revolving windings. They are not considered advantageous, except for particularly high speeds. The first such machine, built early in 1894, was one of those for the testing room mentioned above. In order to be able to test motors at all different frequencies for which they are required, it was necessary that this generator should have a large range of speed, and the "inductor" type was consequently adopted. Fig. 4 shows such an alternator with the top half removed. It will be seen that

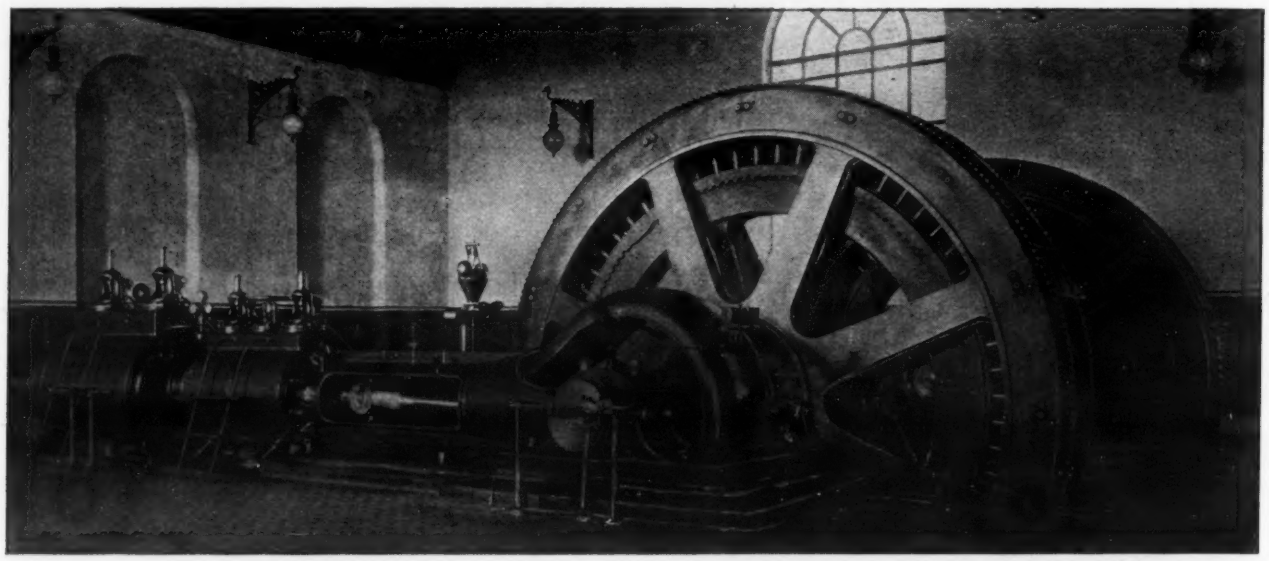


Fig. 5.—750-hp Generator at Frankfort.

the magnets consist of two steel castings in the form of a cross, arranged with their poles staggered, so that the poles of one are opposite the spaces of the other. This allows of a single set of armature windings being employed, carried straight through the core and acted on by both sets of poles, instead of double windings, having their connections inclosed and inacessible between the two cores. Quite recently Messrs. Brown, Boveri & Co. have turned out a machine of this type for an output of 200 horse-power, at 1300 r. p. m. This machine is to be driven by a Pelton wheel on a high fall in Spain. Another large machine of this type, of which three are now in progress in the works, is intended for an output of 900 horse-power at 500 revolutions.

For single and multiphase generators of 200 horse-power and upward, Messrs. Brown, Boveri & Co. have created a special type of machine, of which a good example is shown in Fig. 5, representing the 750-hp single-phase alternators, for the town lighting plant in Frankfort-on-Main. It will be seen that they have departed from the time honored custom of providing the armature with feet resting on the concrete foundation or on a bedplate bolted to the engine frame. In these machines the armature is provided with two spider frames, which are carried on trunnion rings cast on the engine bearings. By adopting this arrangement the concentric position of the armature, with respect to the magnet wheel, is assured, and the whole construction is greatly stiffened. The armature is held from turning by means of bolts on either side. By withdrawing these the whole may be turned by means of a barring gear, in the same way as a fly wheel, so that every part is easily accessible for examination and cleaning. The same construction is clearly seen in the machine for Paderno, Fig. 6, as well as that running in the central station of Munich, Fig. 7. In machines of this type all the poles are wrought iron and are round, as sufficient space is available without resorting to the arrangement described in the case of smaller machines. The windings are of copper strip, wound on edge on a mandrel, the successive turns being insulated from one another by means of varnished paper. The winding was first employed by the firm five years ago, and has since been used in all the larger machines. The armature winding is similar to that described in the case of the smaller machines. In those for the Frankfort central station the armature core is made in small interchangeable segments, so that in case of accident it is easy to remove one and replace it by another. But this arrangement is not usually adopted, as with the method of winding used the security is such that an accident is almost impossible, while a new coil can be wound in a very short space of time.

A new generator, of similar design to the four 750-hp machines already mentioned, has just been erected, and has already been run. This machine is built for an output of 1500 horse-power at 86 revolutions, when working on a circuit having a power factor of only 70 per cent., so that if employed for lighting alone it would have an output of at least 2000 horse-power. The weight of the machine complete is 110 tons; the armature, with its spider frames, weighing alone 53 tons. The outside diameter is 26 feet. Figs. 8 and 9 show parts of this machine in the workshops. It is the largest ever built on the continent of Europe, and there are probably few, if any, larger in the world.

Fig. 10, illustrating a three-phase generator for 450 horse-power at 90 revolutions, shows another type of machine on somewhat similar lines. It will be seen that the fly-wheel carries the poles inside its overhanging rim, while the armature, supported in this case on one bearing only, is placed inside it. This arrangement is of advantage in the case of machines for moderate outputs at low speeds, as it permits of the fly-wheel being made of greater diameter than the armature, instead of less, as in the case of the Frankfort type.

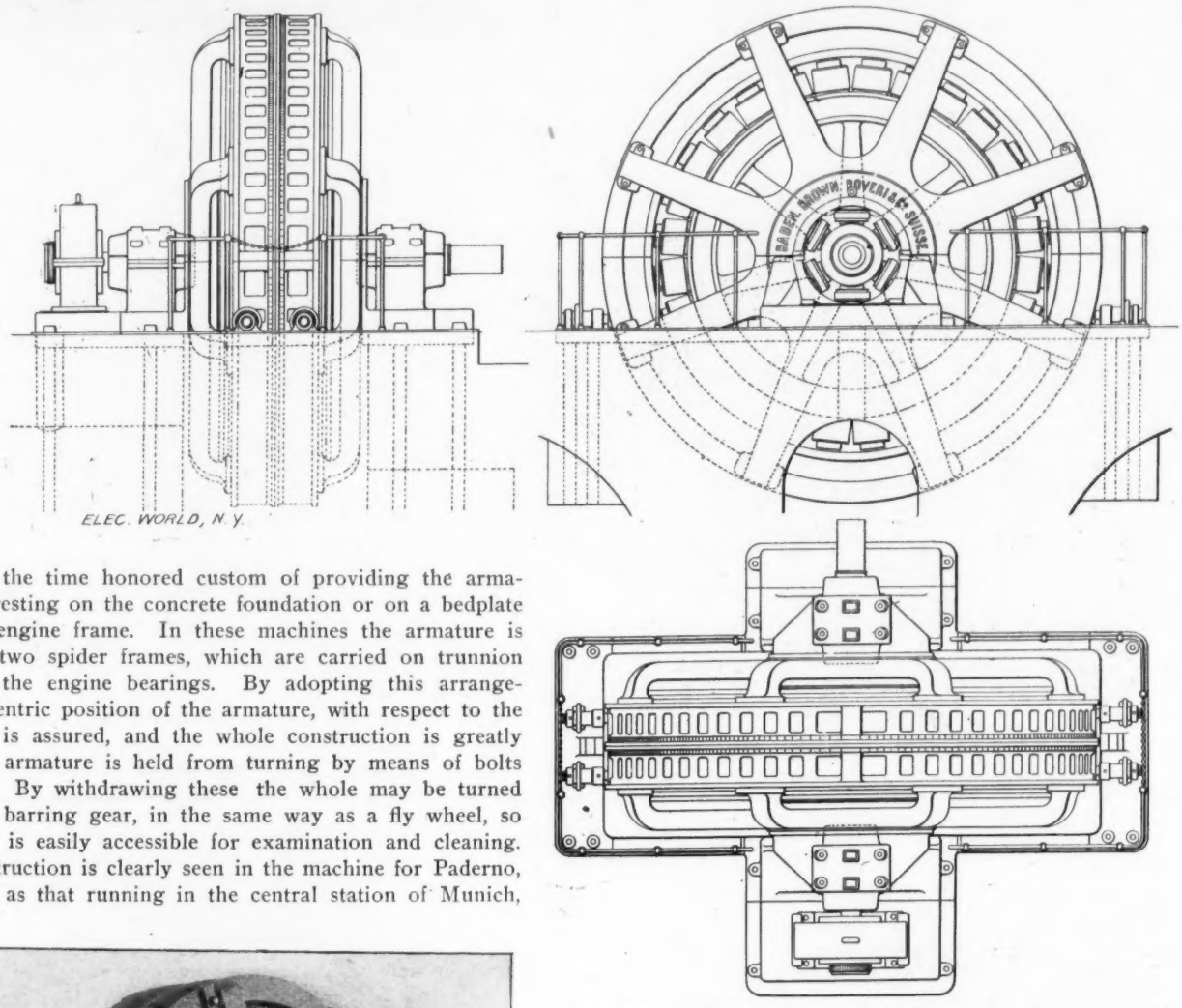


FIG. 6.—ELEVATIONS AND PLAN OF MACHINE FOR PADERNO.

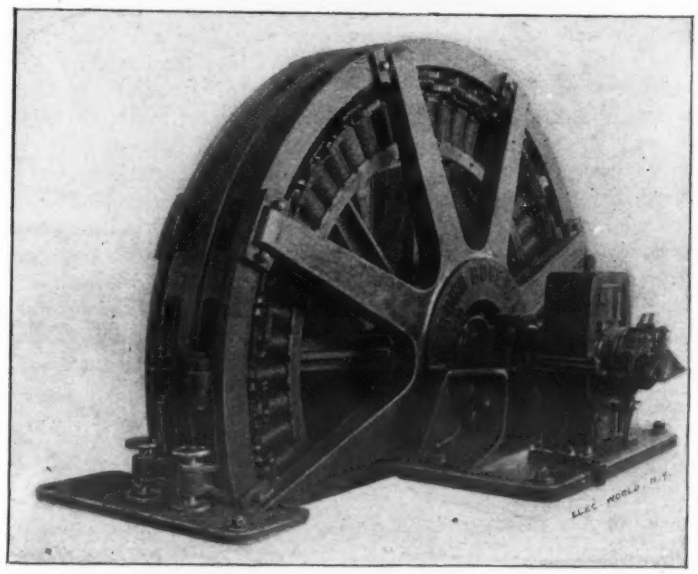


FIG. 7.—500-HP GENERATOR AT MUNICH.

Messrs. Brown, Boveri & Co. have for some time being working in the direction of increasing the tension for which their large alternate current generators can be built, thus avoiding the use of step-up transformers on long-distance transmission plants. By great care in the selection of the insulating material employed, and thanks also to the arrangement of windings adopted on all their larger machines, they have been able to generate directly tensions which render step-up transformers quite unnecessary in most cases. In the central station of Schwyz, where power is derived from the River Muota, to be distributed to a radius of about 15 miles, the tension is 8000 volts, generated directly in the two 600-hp generators there installed. Even in the case of smaller generators this tension works satisfactorily, as a plant with 250 horse-power and 8000 volts is at work in Spain.

But the boldest advance was made when it was decided to construct the generators for the transmission of power from Paderno to Milan, a distance of 22 miles, for a tension of 13,000 to 15,000 volts. It is, perhaps, needless to mention that Milan is one of the most advanced cities in Europe in its electric plant. The Società Edison, finding its central station in the heart of the city insufficient to meet the demands for current, has recently put down a steam plant in one of the suburbs, where three of Messrs. Brown, Boveri & Co.'s generators, of 1000 horse-power each, produce three-phase current at a tension of 3500 volts, which is transmitted by underground cables to the converters, placed in a building adjacent to the old generating station. The high-tension three-phase current here drives synchronous motors of 450 and 750 horse-power, which are coupled to continuous current machines feeding into the three-wire network and trolley lines of the new tramway.

It is to supplement this steam plant that the Società Edison has decided to put down the important water-power station at Paderno. They have placed an order for four generators of 2160 horse-power each, but the station will eventually take three more such machines. The general arrangement of the generators is shown in Fig. 6. It will be seen that they are more or less similar to the Frankfort machines, with the exception that they are self-contained, the projecting shaft being coupled to the end of the turbine shaft. The current will be transformed down to 3500 volts, for putting in parallel with the steam plant already mentioned.

(To be Continued.)

Fig. 9.—Half Frame of 1500-hp Generator.

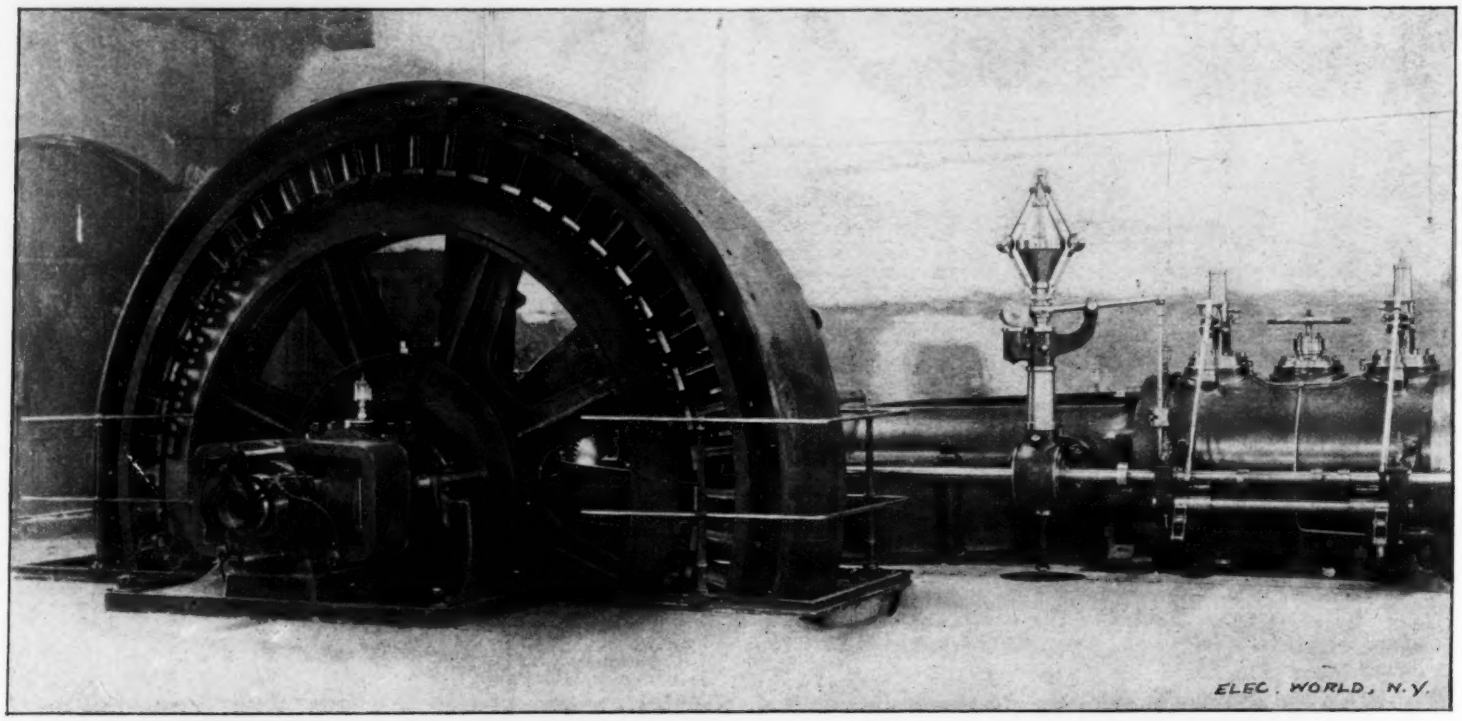


Fig. 10.—450-hp Generator in Heilbronn.

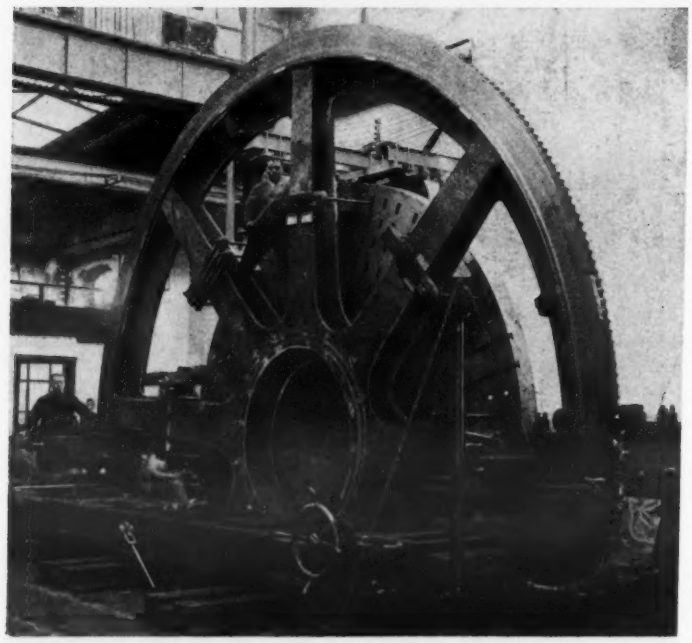


Fig. 8.—Frame of 1500-hp Generator for Frankfort.

An Austrian Technical Paper.

The publication of a new electrical paper, entitled *Elektrotechnischer Neuigkeits-Anzeiger und Bezugsquellen-Wegweiser* (The *Electro-Technical News-Advertiser and Reference-Guide*) has been started in Vienna.

The Past Year's Advance in the Art of Telephony—II.

BY KEMPSTER B. MILLER.

Of great interest and perhaps importance is the work of John W. Gibboney. In 1892 he brought out a method, then broadly new, of transmitting speech, which consisted briefly in impressing on the line an alternating current of such character as to be inaudible in the telephone receiver and of superimposing on it the waves of current corresponding to the acoustic waves of the voice. The alternating currents were either of such high period as to be above the limit of audibility in the receiver or else of such low period and gradation as to be scarcely noticeable. The transmitter was caused to vary the self-induction, capacity or resistance in a circuit in inductive relation with the line circuit, in accordance with the voice waves, and to thus induce fluctuations in the current traversing the main line, which would, in turn, correspond to the voice waves. In July two patents were granted to Mr. Gibboney,

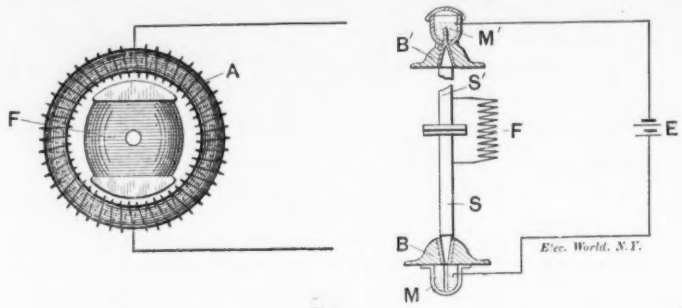


FIG. 5.

showing improvements and developments of this same general system. In Fig. 5 are shown the details of a generator for producing a true sine current upon the line. *A* is a stationary Gramme ring armature in which revolves a constantly excited field coil *F*. In order to secure smoothness of the current in the field coil, the ends of the spindle on which the coil is mounted are immersed in mercury cups *M M'*, shown in the cut at the right of this figure. These cups, which form the terminals of the coil *F*, are led to the terminals of the battery *E*, which supplies current to the field.

An improvement in the method, as brought out in 1892, and as described above, is made in order to do away with the necessity of rendering alternations normally impressed upon the line of an extremely high or extremely low period.

It was found undesirable to make these alternations of such low frequency as to be inaudible, because a certain fluttering of the diaphragm was caused thereby, which, while it did not render the

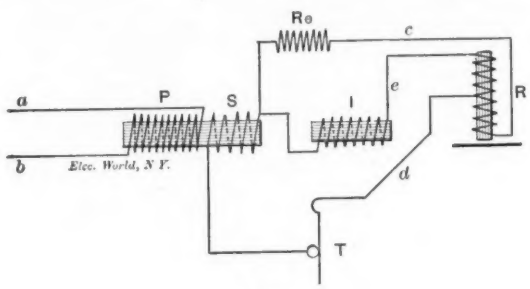


FIG. 6.

system inoperative, caused very brief periods of discontinuity of the speech vibrations. The system shown in Fig. 6 was therefore devised: *a b* represent two sides of a line wire leading to the central station, and upon which an alternating current of the desired periodicity is supposed to be flowing. *P* is a primary winding in the line circuit, and *S* is a secondary winding, wound upon the same iron core as *P*. The circuit from the coil *S* is branched, one part going through a self-induction coil *I* and the conductor *e* to the receiver *R*, and the other branch going thereto by the conductor *c*, having no self-induction coil, but instead a resistance *Re*, equal in amount to the ohmic resistance of the coil *I*. The return conductor *d* may include a transmitter *T*, or some other device for varying some or all of the electrical properties of the circuit, in accordance with the sound waves. The magnetizing effects of the two coils upon the receiver are opposed to each other, so that any current passing equally from the coil *S* through paths *c* and *e*, will have no effect upon the diaphragm of the receiver. By properly selecting the self-induction of the coil *I*, the alternations induced from the fundamental current on the line into the coil *S* may be made to pass equally through paths *c* and *e*, and thus have no effect upon the receiver diaphragm. The rapid undulations in the current, however, corresponding to the acoustic vibrations set up at the other end of the line will pass almost entirely through the branch *c*, being barred from passage through branch *e* by the self-induction coil *I*. These currents, therefore, will produce the desired effect upon the receiver, inasmuch as they pass through but one of its coils. This method is broadly new, and is certainly ingenious.

Not satisfied with the innovation of transmitting speech by superimposing undulations set up by voice waves on a current already alternating in character, Mr. Gibboney has gone further, and shown several methods of using polyphase currents in transmitting speech. A preferred form of this system is shown in Fig. 7, in which *A* is a generator built on the same general principle as that shown in Fig. 5, but designed to deliver two-phase current to the line. The telephone receivers *O* and *O'* at each station are

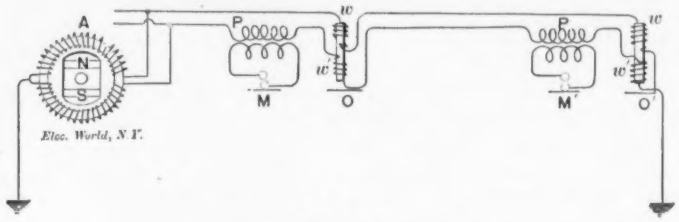


FIG. 7.

provided with two opposite windings *W W'*, one in each side of the line circuit. Connected also in one of the line wires is the primary *P* of an induction coil at each station. In the secondary of this coil is connected a transmitter, *M*, which may, as in the system described above, vary the resistance, self-induction or capacity of its local circuit. Variations produced in the transmitter serve thus to vary the impedance of the primary coil in the line wire, and thus superimpose upon one of the phases of the current originally impressed upon the line small undulations corresponding to the voice waves. Where the two phases from the alternator *A* are 180° apart, the resultant magnetizing effects on the cores of the receivers are nil, but the undulations corresponding to the voice waves impressed on one of the phases produces its effect, it passing through but one of the coils of the receivers. The relation of the two phases of the current when operating as above are shown in the left hand portion of Fig. 8, and the resultant current, or that which produces its magnetizing effect upon the receivers, is shown by the small wavy line at the right of this figure. Although each side of the metallic circuit is grounded, all the advantages of a metallic circuit are retained, as any inductive disturbances from an external source will flow equally and in the same direction in the two line wires, and thus produce no effect in the receiver.

Whether these inventions of Mr. Gibboney are looked upon as mere freaks in the art of telephony or as real improvements, which

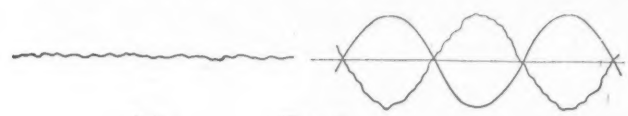


FIG. 8.

may at some future day be of great value, it must be agreed that they are at least of rare interest from a purely scientific standpoint.

That which must be looked forward to in order to bring about telephonic transmission over greater distances and under heretofore impossible conditions is the actual improvement of the conductors over which the transmission is to take place. All authorities have agreed that with our present cables trans-oceanic telephony is a sheer impossibility. So far as I am aware but one reported attempt of importance has been made during the past year, and this by Mr. John S. Stone, of Boston. Mr. Stone, in his patent specification, which all interested in telephony should read, points out and describes the well-known phenomena of attenuation and distortion, and points to a third, which he names "reflection." This latter he describes as being similar to the phenomena of the reflection of light. As it is with light waves, so when a series of electric waves pass from one medium to another having different

electrical properties (as from an overhead to a submarine line), a portion of the waves are reflected and pass back over the line, thus interfering with the oncoming waves. By mathematical and logical demonstrations he shows that all of these phenomena, so deleterious to good telephonic transmission, can be greatly reduced by the addition to the circuit of a suitable distributed self-induction in order to neutralize the effects of distributed capacity. These facts have been long understood, but are most lucidly pointed out in Mr. Stone's specification. For the purpose of increasing the inductance of a wire it is surrounded with a cylinder of magnetic material, such as iron, and in order to prevent the current from flowing along the surface of this iron cylinder, which it would do, owing to the well-known skin effect in alternating current working, he separates the iron cylinder from the copper core by a thin film of insulating material. For the further prevention of the current from flowing on the outside of the iron sheath, and also for reducing the electrostatic capacity between the copper and the iron, the iron cylinder is made discontinuous at short intervals of its length.

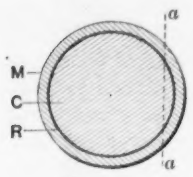


FIG. 9.

Fig. 9 is a cross-section of the cable or conductor where *C* is the copper core, *R* the insulating film and *M* the outer iron cylinder. Fig. 10 is a longitudinal section of Fig. 9 on the line *a a*. In this the interruptions in the continuity of the iron sheath are clearly shown. As an illustration of the increased efficiency of this conductor, Mr. Stone says: "For instance, I have found that a telephone line having resistance of 2640 ohms and a distributed capacity of 4.11 microfarads is about 200 per cent. more efficient with an inductance of 3.175 henrys than with an inductance of .915 henry."

The time-worn problem of the telephone relay has been attacked by Mr. A. W. Erdman. His device is shown in Fig. 11, and embodies entirely new principles in this line of work. In this figure *L* is a line which is supposed to be repeating into a second line L^2. The diaphragm *H* of the receiving instrument *J* is used to operate a valve, V^2, which by its motion varies the flow of an otherwise constant stream of air flowing through a chamber, *C*, which is covered by a flexible diaphragm, *D*. The vibrations of the receiver diaphragm are therefore reproduced in an amplified form on the diaphragm *D*, covering the air chamber, and this diaphragm serves to operate a microphone, *T*, which varies the current in the local sircuit, and thus induces undulations of current in the second line circuit L^2 in the ordinary manner. *R* is a reservoir containing compressed air, and *V* is a reducing valve, operated by a hand wheel, *W*, to regulate the amount of air escaping. In the valve V^2, which is of a balanced type, *E* is a flexible diaphragm, and *A* the movable portion which controls the outlet. The centres of the diaphragm *E* and of the valve plate *A* are connected by the rod *r* to the centre of the receiver diaphragm *H*. The balancing of the valve V^2 renders it extremely sensitive, so that it may be set in operation by the delicate movements of the diaphragm *H*.

No reports have been received as to the efficiency of this relay in actual operation, but it seems that this may be a step toward the successful solution of this difficult problem. Instead of employing the mechanical connection commonly used between the

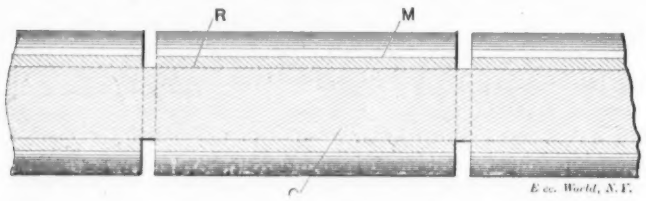


FIG. 10.

diaphragms of the receiving and transmitting mechanisms, Mr. Erdman has, in his current of air or gas, chosen one of the most delicately subtle mediums known.

No article pretending to give a résumé of the work in telephony during 1897 would be complete without some mention of the inventions of Milo G. Kellogg. During the past ten years he has been assiduously at work filing applications in the patent office for alleged improvements in multiple switchboards. It is not known exactly how many applications were filed, but his efforts resulted in the granting of 125 patents on October 26. If for no other reason, these are interesting in that they form the largest issue of patents ever granted to one man in one day. Very little originality seems to have been shown by Mr. Kellogg in the perfection of mechanical details, which are matters of such great importance in successful exchange working. In fact, considering the vast amount of diagrams and words in these patents, surprisingly few radically novel ideas are found, the greater number of the patents being based on apparently minor changes in a few fundamental ideas. The feature of having the test for "busy" lines depend on other conditions than the switching or plugging of a line at another board has been given considerable thought by Mr. Kellogg. In many of his systems a line will test "busy" as soon as the subscriber removes his telephone from the hook, whether or not the line is plugged at some other board than that at which the test is made. In other systems the drop in falling either opens or closes the test circuit, so that a line tests "busy" as soon as the subscriber throws his drop. Many of the patents cover mere changes on these ideas.

One of the most interesting of his systems of testing for busy lines in multiple boards is one where a source of intermittent current is normally included in the circuit of each line, but is cut out when a line is plugged for use at any board, so that an operator in testing knows that the line is free if she hears the flutter of her test instrument due to the intermittent currents. The fact seems to have been overlooked that these intermittent currents flowing in each free line would unquestionably, by virtue of static induction and leakage, cause a buzz in all of the busy lines. In my opinion this system is practically inoperative for that reason.

For handling very large exchanges, Mr. Kellogg has invented

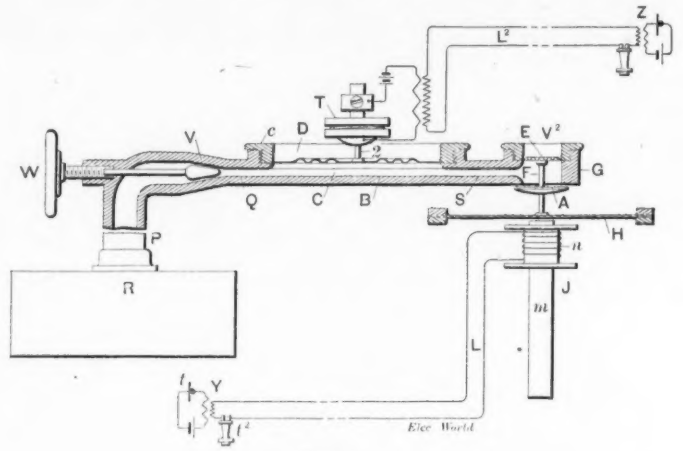


FIG. 11.

a number of divided multiple board systems, some of which will probably prove factors in the telephone industry in the immediate future. In these he divides the lines into four classes, and divides the switchboards into corresponding classes, one class of boards for each class of line. Each line has a spring jack on each board of its own class, as in the ordinary multiple board, and also one jack on one board of each of the other classes. Each line has also four polarized drops, one at each class of the exchange, two of opposite polarity being connected between one side of the line and ground and the other in a similar manner between the other side of the line and ground. These drops are always located at a board where their particular line has a spring jack. The subscriber may, by sending a current of either polarity over either line wire and ground, throw his drop at any one of the four classes of the exchange he desires.

In operation, if a subscriber in class *A* desires to call one in class *D*, he sends, for instance, a negative current over the test side of the line, which operates his drop or annunciator at class *D* of the exchange. As the called subscriber belongs to class *D*, his line will have a jack upon every board of that class, and the operator at whose board the calling subscriber's drop was thrown can, as in the ordinary multiple board, make the connection with a pair of her own plugs.

Owing to necessary limitations of space in an article of this nature, many points of unquestionable interest and merit must of course be omitted. No attempt has been made toward giving all the points of real development, but only those which seem most striking, and which best illustrate the tendency of our present progress.

The Evolution of the Rail Bond—II.

BY HAROLD P. BROWN.

This lack of continuity in the cast-welded joint is clearly shown by Figs. 13 and 14, which were photographed from joints at St. Louis and Chicago. The resistance of these joints after a few years' use averages about that of a No. 00 copper bond, and steadily increases. This is proved by hundreds of measurements on roads in Newark, St. Louis and Chicago.

FIG. 13.—BROKEN "CAST-WELD" JOINT FROM ST. LOUIS.

Welding copper bonds to the web of steel rails has so injured the steel that the rail ends have split through the bolt holes. Welding to the base of rail has still left a joint of high resistance, from thermo-electric causes. Dissimilar metals cannot be heated when in contact, without a serious change of character.

Thus, the steel-cored trolley wire has less tensile strength and

FIG. 14.—SECTION OF "CAST-WELD" JOINT SHOWING RAIL ENTIRELY LOOSE IN CASTING.

greater electrical resistance than two separate steel and copper wires of same cross section. As for a bond depending upon solder for contact, any acid used increases the metal's resistance, and prepares the way for constant and progressive corrosion. If even a small portion of lead, zinc, antimony or tin is used, electrolysis soon leaves the solder a mass of high-resistance oxides, when used in damp soil.

In Mr. Edison's railway experiments at Orange, from 1888 to 1890, it was necessary to obtain perfect bonding, since low voltage and heavy currents were used. The Menlo Park nickel plating was found to have been undermined by iron oxide after a few years' exposure. This oxide is of extremely high resistance and will find its way even under the head of a steel rivet set up in a boiler plate with hydraulic pressure. As it is porous, it admits more more and more moisture to complete the work of destruction

Mr. Edison found that no mechanical device could hold steel and copper close enough together to exclude this unwelcome visitor, because of their differing expansion rates. After trying all other methods of bonding, he returned to the contact metals and methods which, he says, made a success of the Edison "Jumbo" armature. This consisted of an alkaline amalgamation of the contact surfaces, upon which was spread a thin layer of a low-resistance plastic amalgam. The amalgamation not only filled the surface irregularities and penetrated into the metals for a perceptible distance, but it left each molecule in such a condition that it exerted by adhesion an attractive force npon surrounding molecules. It is well known that adhesion is more powerful between a liquid and a solid body than between two solids; also that the attraction between liquid and solid is much greater if the liquid can wet the solid.

The Edison amalgamation of copper or steel gives each metal a surface which mercury can wet, and the tremendous force of the resulting adhesion serves to make a perfect electric contact. So perfect is this contact that a copper bar can be sawed apart and yet be restored to practically its original resistance by the process. This is better than can be done with the best solder, and, therefore, these metals have come into extensive use for switchboard contacts in the leading power houses. Generally they are first used on a hot watt-meter shunt or a troublesome switch, and the engineer in charge learns by experience that a contact may be poor even between carefully-fitted copper surfaces strongly bolted together.

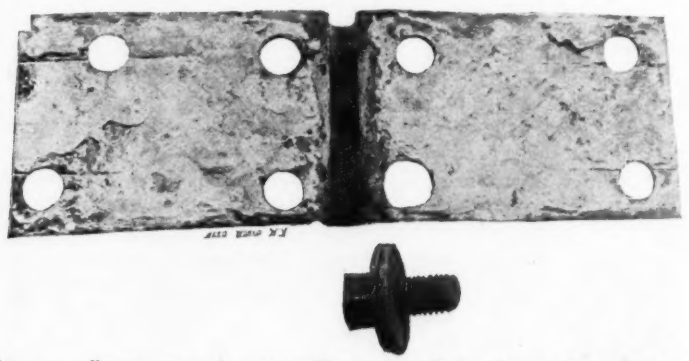


FIG. 15.—COPPER AND AMALGAM BOND AND BOLT AFTER FIVE YEARS' USE.

Last month it was necessary for the Weston Electric Instrument Company to calibrate one of their millivoltmeters to a 7-foot length of 90-lb. rail as a shunt, to be used as an ammeter reading to 1500 amperes, which is the carrying capacity of that size of rail. This company's employees are certainly experts in making good electrical contacts, but, although they did their best, it was impossible to get a heavy current through that rail with the battery they use for calibrating instruments to their ordinary shunts.

They asked the writer to give them a place where "more potential could be had" for the purpose. With broad contact plates carefully filed and fitted, and held together by very heavy bolts, the contact resistance was still too much to put the proper current through a rail with 4 volts E. M. F. After this experience what can be said of the

"perfect contacts" that are claimed for ordinary copper bonds which are stuck into little holes in rails and compressed by hammer blows or screws? You can get current though them, of course, but never the full load of the rail, and what you do force through requires a large waste of power.

The Weston people were advised to put a little of the Edison alloys on their obdurate rail contacts, and at once their battery was found sufficient to get 1500 amperes through it. They write: "After we used the Edison amalgamation and plastic alloy between the rails and the current terminals, we found that the contact resistance was

Fig. 16.—Blackened Contacts on Ordinary Copper Bond After Eighteen Months' Use.

reduced almost to nil, and we had no further difficulty in drawing sufficient current out of the batteries to make the required adjustment of the instruments."

Some railway engineers follow the Weston example in similar cases; when their pressure drops because of too much circuit resistance, they start more engines and dynamos instead of improving their contacts. And then they calmly tell you that their bonding is

Fig. 18.—The Plastic Bond After Two Years' Use.

magnificent, when a measurement of the electrical drop in a few feet of their rail shows a current of but 40 to 50 amperes flowing through instead of 500 to 1000. It is much cheaper to buy a few millivoltmeters and bring the rail return up to its proper conductivity by rebonding than it is to buy boilers, engines and dynamos to crowd current through faulty joints.

Returning to Mr. Edison's railway work at Orange in 1889, several hundred bonds were left in the track, so that the test of time might prove the permanence of his amalgam contacts when placed underground. Many of these were taken up in February, 1894, and the contacts were found to be in perfect condition. In May of the same year some of the bonds still left in the track were tested with 1500 amperes; the drop was practically the same as recorded in tests made five years before. One of these bonds is shown in Fig. 15, with one of the bolts used to fasten it below rail base. Other types of bonds were put under angle plate.

Some of the history of this work is shown in the Edison railway patents. Figure 16 shows condition of contacts on ordinary copper bond after but eighteen months' use; this is one of several hundred removed from 90-pound rail where a pair at each joint transmitted but 25 amperes, instead of the proper load of 700 to 1000. With Mr. Edison's assistance, the writer devised the form known as the plastic rail bond, which is shown in Fig. 17, and has since earned an international reputation for low resistance and durability.

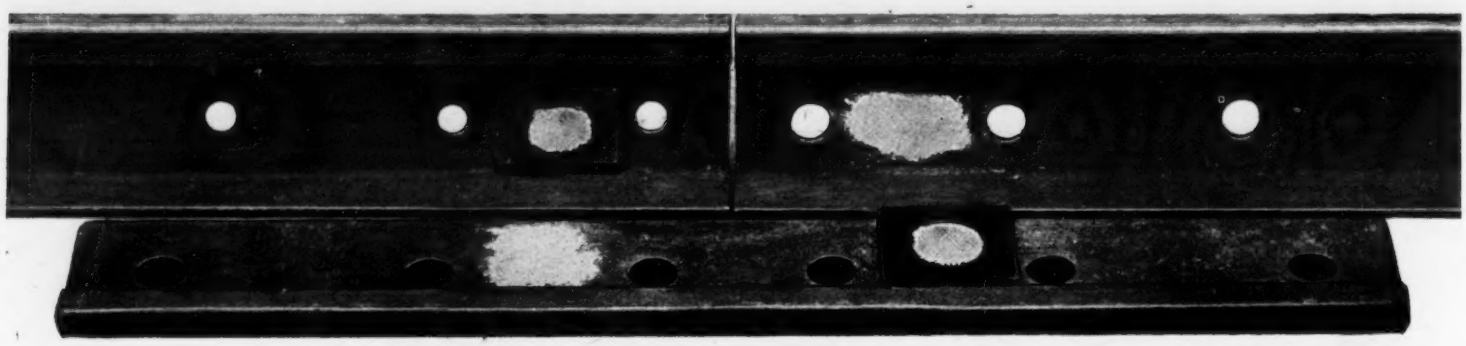


Fig. 17.—The Plastic Rail Bond.

Contact spots on rails and angle plate are amalgamated by the Edison process, and contact is completed between them by the Edison plastic amalgam. This is surrounded and held in place by an elastic cork washer, which, though compressed one-half when applied, will return to 90 per cent. of its original thickness if the angle plate slackens. Fig. 18 shows the plastic bond after two years' use, as good as new.

Other forms have been designed for special purposes, as the rebonding of girder rails in paved streets without removing the pavement, etc. But in all forms of copper bonds, the use of the Edison amalgation and plastic alloys between the meeting surfaces calls into action the tremendous power of adhesion to cut down the contact resistance and prevent corrosion.

A Change in the Patent Office Laws.

On January 1, 1898, some important amendments of the United States patent laws went into effect, affecting particularly the interests of those taking out patents in the United States and foreign countries. There has been added to Section 4887, declaring that no person shall be debarred from receiving a patent by reason of its having been first patented in a foreign country, the following exception: "Unless the application for said foreign patent was filed more than seven months prior to the filing of the application in this country, in which case no patent shall be granted in this country." This limitation will, of course cause foreign patentees to forfeit their rights to United States patents unless they file their American applications within seven months after the time of filing the first foreign applications.

On the other hand, the long standing requirement that "every patent granted for an invention which has been previously patented in a foreign country, shall be so limited as to expire at the same time with the foreign patent," is abolished by this change; so that all patents issued under the new law will run for the full term of seventeen years, regardless of the issuance of foreign patents either before, simultaneous with or after the American grant. There will be, of course, no further necessity for the granting of patents in foreign countries simultaneously with their appearance in the United States.

A new defence can be set up to an action for infringement of a patent granted under the new law, namely, "That it (the invention) has been patented or described in some printed publication * * * more than two years prior to the application for patent therefor." Such two years prior publication will bar the grant of a valid patent under the new law.

Another amendment changes the time limit below which an applicant for a patent must proceed with his application in the Patent Office from two years to one year after the official action.

Some Difficulties of Heavy Electric Railroading—II.

BY LOUIS BELL.

For higher working voltages than that mentioned we are at present compelled to rely on boosters, or on power transmission with storage batteries, or rotary converters. Each of these is a method of wasting energy, at a considerable expense for apparatus—a method useful in making the best of a bad matter, in default of anything less wasteful. All three may find useful applications, and their relative value depends on local conditions more than upon marked inherent advantages. Generally, however, it is safe to say that the application of storage batteries on any considerable scale is of very limited applicability, and the main reliance of the engineer must be upon the other methods. Unfortunately, each of them wastes energy, generally to the extent of 25 per cent. or so. The booster system, however, has its greatest efficiency at rather light loads, while the rotary converter does its best work at or near full load. This difference may sometimes form a desirable criterion in choosing one or the other, and both may find useful applications in the same plant. The longer the distances involved, the better the relative economy of the rotary converter. In either case, the system of working conductors is practically the same. A far simpler way out of the difficulty would be the use of a higher working voltage at the motors, which would both save copper in all the conductors, and simplify the delivery of energy in large units.

A rise in the working voltage to 750 would more than cut in two the cost of the copper required, and would render boosting, or power transmission, quite needless, except as methods of mutual assistance between power houses, in a very large proportion of the heavy work which looms up in the immediate future. But, unhappily, practically nothing has yet been done in this line, and power distribution still remains a serious stumbling block in the way of extensive suburban work. It is to be hoped that the attention of engineers will be concentrated on this problem, for there is every reason to suppose that it is quite practicable to build generators and motors every whit as reliable as the present ones, for this increased voltage. The production of such machines is requisite before the locomotive can be attacked in its stronghold, or, as another alternative, alternating motors must be developed to the point where they can be generally used at least in this heavy work, which is in most respects far less trying than street railway service. Pending these improvements, heavy electric traction has still a large field in the work of heavily loaded lines over relatively short distances, but will continually encounter annoying limitations.

With alternating motors, polyphase or other, capable of being worked from a high voltage trolley line by transformers on the car, or even supplied from stationary transformer stations along the line, it would be possible economically to operate long lines, and to attack a wide range of transportation problems which are quite out of the reach of present methods. The other alternative, however, is of great and immediate importance in doing the work which lies directly ahead.

Whatever may be the ultimate method of high-tension feeding, there is a present and most urgent matter for consideration in the problem of the working conductor. There is a wide difference between street railway practice and what is necessary in handling the heavy currents required to duplicate the work of the steam locomotive. What arrangement of working conductor will best enable us to take energy to the amount of 200 to 500 kilowatts while running at 30, 40, or even 50 miles per hour? The question is as yet unanswered, although fortunately there is now a varied store of experiments from which to draw data bearing on the subject.

And right here we encounter the very serious difference between starting from the beginning and building up a new suburban rapid transit system, and adapting electric traction to an existing system entering a great terminus over tracks which must be often used in common with through trains and locals belonging to other routes or other roads, and criss-crossing through yards filled with freight traffic.

In the former case, the working conductor can be designed to meet the electrical conditions alone; in the latter it must of necessity be kept out of the way of all other traffic, high enough not to interfere with freight brakemen, or low enough to dodge the firebox and running gear of the squattest locomotive that may chance to come that way. Further, it must be out of the way at switches and crossings, and be so placed as not to be a menace to those whose work is in the yards.

With these conditions eliminated the task is an easy one, as in the case of electric elevated railroads, where the third rail seems to meet the requirements in a manner that leaves little to be desired, but in general work the difficulty is a real and serious one. With terminal and traffic conditions very much modified, the recent experiments at Nantasket and New Britain have been reasonably successful, but leave a good many questions of interest unanswered. They are, however, of such importance, as pioneer work in the greater field, that they merit careful examination. Information regarding them has been sadly lacking until very recently, when a descriptive paper was read by Col. N. H. Heft, at the meeting of the American Street Railway Association, which is well deserving of careful scrutiny. The first point of importance in this particular connection is the failure of the overhead trolley in this class of service. The first experimental line at Nantasket was equipped with the overhead system, employing a trolley wire of about 330,000 c. m. section, of a shape planned to give as much contact surface as practicable. After an experience lasting now over two seasons of summer traffic, Colonel Heft states that it has been found "quite impossible to prevent the destruction of trolley wheels by almost continual arcing." And this condition applied not only to the period of starting and acceleration, but to steady running at full speed. In addition, there was much trouble from the trolley wheel jumping from the wire at high speed or on curves. And it must be remembered in this connection that the trains on the Nantasket line were short and frequent, as they would naturally be on an electric system. Of course, a trolley wire even larger, with special trolley wheels, might obviate a portion of this difficulty, but unless energy were delivered at a considerably higher voltage than the 600 or thereabouts employed, trouble seems imminent.

Driven from this plan by experience, a bold step was taken in installing a centre rail and taking current from it by contact shoes, as had been done with a side rail in electric elevated work. Of course, in this heavy service possible leakage is of relatively far less moment than with the more moderate currents common in street railway work, and there is, too, much less chance of leakage. For the centre rail is supported on low insulators, and a well-ballasted railway roadbed is a poor conductor at best. The insulators, however, are of treated wood only, and have not yet been in place long enough to allow deterioration to appear at anything like its full value. Creosoted wood is certainly not a good enough insulator for permanent use. The actual leakage found on the Nantasket or the New Britain line has not been made public, although it is a matter of greater interest perhaps than any other single characteristic of these plants. The latter road, however, has been operated during the past summer, even when the track was flooded at one or more points, without serious difficulty, and on one occasion, when the track was flooded at two points, there was not enough leakage to start the station wattmeter. As this is, of course, a very large instrument, it is quite safe to say that a leakage of even 50 kilowatts might easily fail to register. After the road has been in operation another year or so, leakage data will be more interesting.

But right here interposed one of the annoying details consequent upon changing over an ordinary railroad. In order to clear the ash pans of the locomotives which on occasion might have to run over the New Britain-Hartford and Nantasket lines, it was necessary to carry the centre rail very low, not over 2 inches above the ties, the insulating block being only about 4 inches high, thus putting the insulation at a manifest disadvantage. For the same reason it was necessary to spread the rail out laterally to get sufficient cross-section, which makes it difficult to apply guard planks to prevent accidental contact with the rail.

Fortunately 600 volts is not a highly dangerous potential, and the worst accident so far has been the occasional sudden demise of a stray dog. Of shocks to employees there have been many, sometimes enough to throw the victim off his feet, but nothing, as yet, more tragical; 600 volts, however, is getting near to the point where danger may be anticipated, and it would be highly desirable to use guard planks in any future installations. This will be the easier, since it is certain that on any extensive system supplementary feeders will have to be used, removing the necessity for so wide a rail. The line in question is 12.3 miles long, 3 miles being double track, and very perfectly bonded throughout, yet with two two-car trains in operation the *average* drop was stated to be 26½ per cent., with an average cur-

rent of 300 amperes. Obviously, even with a moderate increase of traffic, feeders would be necessary, and even were the station in the middle of the line, instead of at one end, the 100-pound centre rails would be quite inadequate to carry current for a really heavy service.

How the centre rail system will work on an important suburban line is somewhat problematical. Properly guarded it could be carried safely, even for higher voltage than at present, but its course through the maze of switches and crossings in a crowded yard would be beset with difficulties. In many cases these could be overcome, but, after all, the value of the centre rail hinges on the character of the insulation which can be steadily maintained with a rail necessarily carried close to the ties. And this is at present an unknown quantity. It is certainly better than would appear at first sight, and can be still further improved by improving the insulators and arranging the ballast to facilitate drainage.

Were it not for the trouble encountered in yards and at crossings, a side rail carried high enough to insure good insulation would serve the purpose admirably, as indeed it doubtless would in favorable localities, since it can be very thoroughly protected against accidental contact and the effect of storms. But even then the range of available positions is small if the third rail is to be supported on the ties and locomotives are to be used on the same track. If the rail is not carried on the ties a very solid supporting structure is necessary to secure alignment, and the further the third rail is from the track the more trouble from oscillation in attempting to secure good contact. Perhaps, particularly for heavy work, a pair of lateral rails, one outside of each of the track rails, would prove more available.

In any event the extension of electric traction to cope with the work now done by heavy locomotives on through lines involves still further difficulties with the working conductors. The device used in the Baltimore tunnel is effective, but involves a somewhat troublesome and costly superstructure, and would lead to endless and grave complications in working through yards.

The most hopeful line of simplification is increasing the working voltage materially enough to reduce the current through the working contacts. With alternating motors and transformers on the cars it might be quite feasible to employ an overhead trolley wire, even when delivering large amounts of energy, and even with continuous current motors a rise of 50 per cent. in voltage would render the task of getting current perceptibly easier. Of course, any rise in voltage increases the chance of leakage, but this question must be met on its merits in any event.

The most favorable condition of work is when it becomes possible to set apart certain tracks for electric traction and to equip them without respect to locomotive haulage. This, of course, may remove the possibility of help from locomotives in case of breakdowns, but if electric traction on a large scale is to be undertaken it must stand on its own legs. A system which felt the need of holding locomotives in reserve could not expect to gain or retain public confidence as a full substitute for present methods.

After the New Britain-Hartford line has worked through the present winter we shall know more about electric traction under railway conditions than at present, but even should serious trouble be met from snow and sleet there would be no good cause for discouragement, since the third rail is in a somewhat disadvantageous situation, and there has been as yet no experience to guide to the best method of clearing the conducting rail.

At present few railway systems can set aside much track for exclusively electrical use, and yet there is a considerable group of suburban lines without important through connections on which electric traction could be successfully installed with our present apparatus and appliances, or with comparatively slight modifications thereof. Of the very great value of an electric service in getting traffic there is no need here to speak, for it is perfectly well known to every railway manager, generally by bitter experience. That the change to electric methods greatly increases receipts and is often capable of reducing expenditures where the service is heavy admits of no doubt. The mere improvement in acceleration is very valuable in conducting suburban business, in which most of the run consists in alternate acceleration and braking. It has been the purpose of this paper to point out the need of walking firmly before we attempt to fly, to show that we cannot yet see our way clear to undertaking economically the general service of a great railway, and to indicate the source of the difficulties ahead. Nothing is gained by overconfidence, and many a battle has been lost by it.

The writer has no manner of doubt that within a very few years all elevated railway service and very extensive suburban service will be carried on electrically. Indeed we are now nearing the point in civilization when great cities will not tolerate locomotives on elevated roads, and will greatly restrict their use on other lines within the city limits. Perhaps the easiest road to the general use of electricity on suburban railways will be found through the abandonment of the use of locomotives within the city limits, except for the tracks used exclusively for through passenger service. In fact, it would be a great gain if this reform could be carried out. Unfortunately, reforms can be carried out only through the conflict of various selfish interests. These very interests dictate on many suburban lines the use of electric methods as the only successful way of meeting competition by such methods. Their application to more general service is not at the outset a matter of great importance, but in so far as it is practicable it will inevitably be worked out and applied. The work which must be done and is being done to-day is the solution of the lesser problem, not the greater, and this has been in large measure already accomplished, not by ignoring difficulties, but by removing them.

The Choice of Transformers.

The improvement effected by the substitution for old type transformers of those of the most recent and improved manufacture, and by the use of one large transformer in the place of several smaller ones, has been demonstrated very clearly and convincingly in a compilation of reports received from certain electric lighting companies which have made the change. In almost every case the change has resulted not alone in a far more perfect operation of the system, perhaps a minor consideration, but in an actual concrete, tangible saving in dollars and cents.

Improvement in transformer construction and the use of larger units follow naturally after similar developments already completed in the other machinery of many of the large central stations of this country. The replacement of a large number of transformers of small capacity, manufactured when the art of transformer construction was not so well known as it is to-day, by a few improved transformers of large capacity has produced, and is producing, results startling in their importance. The figures shown in the compilation are interesting, and should compel the attention of the manager of every station supplying current through transformers.

The first instance is that of a company operating in a town of 56,000 population in Massachusetts. In this case fifty-seven small transformers, built in previous years, were supplanted by eighteen of one of the latest types. The total light capacity of the superseded apparatus was 1499 lights, of the newly installed transformers 1624. The total core loss of the old transformers was 5866 watts; of the new only 1348. So much for the electrical facts. The saving in dollars and cents is calculated as follows: 39,578-kw hours are saved yearly by the change. The value of the saved energy may be estimated at $527.70—equivalent to a saving per light capacity per year of 35.2 cents. Neglecting all the advantages of the change, except those accruing from the decreased core loss, the expense will be met in one year and nine months.

The light capacity of the plant is increased 9 per cent., the core loss decreased 77.5 per cent. Furthermore, on account of the decreased core loss, not less than 4518 watts are available for sale at the regular rate with the present station apparatus. This enables the company to add ninety lamps to its circuits, producing an additional income of about $675.

The second instance is in another Massachusetts town. Here forty new type transformers supplanted fifty-three old ones. The total light capacity of those returned was 1135 lights, of the new 1070. The core loss in the old type transformers was 4845 watts, in the new type 1343 watts. In this case the annual saving is 30,678 kw hours, or about $409, corresponding to a saving per light per year of 35.2 cents. The expense of the change, counting core loss alone, will be covered in two years and nine months. Thirty-five hundred and two additional watts are available for sale, increasing the income by $525 per year, while, by the use of lamps of a higher economy, some 535 kilowatts additional are also available for sale.

There are still three more striking cases in Massachusetts of benefits derived from a similar change. In the first, the regulation of the station had been so poor that the lamp bills had increased to such an extent that the question demanded immediate attention. While

the saving was comparatively small, the beneficial results brought about by the change have proved highly satisfactory. In the second thirty-one small transformers of old type were replaced by three of a new type. The core loss of the returned transformers amounted to 2568 watts; of the new ones 280 watts. The resultant saving per annum is 20,043 kw hours, or $267; the saving per light capacity per year 25.74 cents. This is an all-day station, and it is calculated that only eight and a half months will be required to wipe out the investment. The third case involves the supersession of 193 old type transformers by thirty-seven new ones, the total light capacity of the former being 6035 lights, and of the latter 8210 lights. The total annual saving is 51,203 kw hours, or $683, and the total saving per light capacity 14.68 cents. In five years and two months the cost of the change will be fully covered. The capacity of the plant has been increased 36 per cent., the energy required to operate decreased 47.1 per cent.; 5845 additional watts were made available, and thus an additional capacity of about 116 lights was obtained without adding to the station apparatus. If these lights were burned but three hours daily, the result would be an additional annual income of $960. On account of the improved regulation entailed by the change, high efficiency lamps can be used, and about 410 more watts saved. This adds $109.46 to the total annual saving.

Several interesting changes have also been made in the West. One instance, in particular, merits attention. The details of the change are not available, but by centralizing the transformer distribution the rate of switchboard income was changed from 4 cents to 12 cents per kw hour. Another Western plant reports that its 1140-volt circuit, equipped with old-style transformers, showed 6 to 7 amperes in the day time, while with the new transformers only a fraction of an ampere is shown.

Facts such as these tend to prove not only that constant improvement is taking place in electrical apparatus, but that station managers are realizing that, to secure the most economical results on their systems, such improved apparatus must replace older types, built when electrical knowledge had not reached its present high standard. A saving here, less trouble there, the extinction of a difficulty at another point, result in a general benefit which can be exactly calculated in dollars and cents, and thus tend to the general well being of the progressive station and communities in which the newer methods are adopted.

An Isolated Plant Driven by Gas Engines.

An isolated electric lighting plant, interesting because of the fact that gas engines are used as the prime movers, without storage batteries or any particular attempt to secure uniformity of loads, is described in a recent number of the London *Electrician*, from which the following points are abstracted:

The station is one of those erected by the Midland Railway Company for the lighting of its termini in large cities. The use of gas power instead of steam in this particular station at Leicester was caused by the lack of available space for a steam plant at or near the site best adapted for a distribution centre. The gas-generating machinery consists of two Dowson gas generators, each capable of generating from coke sufficient gas for 100-brake horse-power, or from anthracite for 120 horse-power. There are two small boilers, each capable of supplying sufficient steam for the operation of both these generators. For each generator a cooler, hydraulic box, coke scrubber and saw-dust scrubber are provided. The gas holder has a capacity of about 2000 cubic feet.

The power-generating room is equipped with a number of Crossley gas engines, belted to direct-current dynamos, for arc and incandescent lighting. Four of the engines have a stroke of 21 inches, with a cylinder diameter of 16 inches, and are capable of developing 90 horse-power at 200 r. p. m. Two smaller engines are provided, capable of developing 50 horse-power at the same speed. All these engines are horizontal trunk piston Otto cycle engines, with valves of the mushroom type, and heated tube ignition. Figures of available power are given for use with coal gas, of which there is a reserve supply kept for emergency use. With Dowson gas the engines give about 20 per cent less power.

Three of the larger engines drive three 60-light 10 ampere Brush arc machines, the fourth driving a Mordey Victoria 110-volt direct-current dynamo. Two smaller 100-volt machines are also belted to the two smaller gas engines. The several loads on the various dynamos and engines are all independent, and subject to considerable variations, the loads on the various high and low-tension machines being comparable for irregularity and trying conditions with those of ordinary steam-driven stations. The variation in load comes back even to the gas generators, as the capacity of the gas holder is only sufficient to run the whole load for about ten minutes. In spite of this, no trouble has been experienced with regulation.

Repairs on this apparatus have not been by any means serious. The engines are carefully overhauled after each run, or, when the lighting is necessarily continuous day and night, as during the time of fogs, they are overhauled when an opportunity can be found. All valves are cleaned once a week the year round, and if necessary are freshly ground. The exhaust valves are turned up every twelve months, and the air valves every two years. The coke in the scrubbers is renewed every six months, and burned in the boilers. The sawdust in the scrubbers is renewed about every 100 hours of working, at an expense of about 60 cents a scrubber. The generator fires are cleaned every twenty-four hours. About 9 per cent. of the weight of the total fuel burned is used in the small vertical boilers employed in raising steam for the air injectors of the generators. The gas generators are found to work equally well over a wide range of weight of production. From full load to one-fifth load, the gas produced is found to range practically of the same quality, giving about 40 calories per cubic foot.

Six other lighting stations, owned by the Midland Railway Company, are all driven by steam power, and the statistics of the expense of working show that the cost per kw hour is practically the same in the gas-driven station as in the steam stations of about the same size.

A Peculiar Power House Accident.

An accident occurred on the morning of December 26 at the Throop Street power house of the Metropolitan West Side Railroad in Chicago, illustrating how closely inter-connected the different parts of a power system are and how any derangement of one part can affect something apparently totally independent. The power plant at the time was fully loaded, owing to repairs being made on one of the four engines, and the recent addition of the load of the Union loop. Early on the morning mentioned there were two short circuits which apparently so roughened the circuit breaker blades that on the next short circuit the breaker failed to open. This overloaded the engines to such an extent that the jet condenser was unable to take care of the exhaust steam, which opened a relief valve allowing the steam to escape under a small independent engine used for running the vacuum pump. The steam wet the governor belt of this small engine, and caused it to slip off its pulley. The speed of the small engine ran up sufficiently to burst the cast-iron fly-wheel which was attached to the shaft. Fortunately no serious damage was done to the building or the other machinery by the bursting of this machine, but until the auxiliary engine was repaired the main engines had to be worked non-condensing, for which they were not designed, cutting down the power considerably and necessitating the reduction of the train service.

A Law for Protection Against Theft of Electric Current.

The following is the text of a bill recently passed by the General Assembly of the State of Georgia providing for the protection of electric lighting and power companies from theft of electric power:

SECTION 1.—Be it enacted by the General Assembly of the State of Georgia, and it is hereby enacted by the same, that, whoever unlawfully and intentionally injures or destroys or permits to be injured or destroyed, any meter, pipe, conduit, wire, line, post, lamp or other apparatus belonging to a company engaged in the manufacture or sale of electricity for lighting or power purposes, or unlawfully and intentionally prevents an electric meter from duly registering the quantity of electricity supplied, or in any way interferes with its proper action or just registration, or, without the consent of such company unlawfully and intentionally diverts any electric current from any wire of such company, or otherwise unlawfully and intentionally uses or causes to be used, without the consent of such company, any electricity manufactured or distributed by such company, shall, for every such offense, be punished by fine not exceeding $100 or imprisonment not exceeding one year, or by both such fine and imprisonment.

Electricity in the Greater New York Celebration.

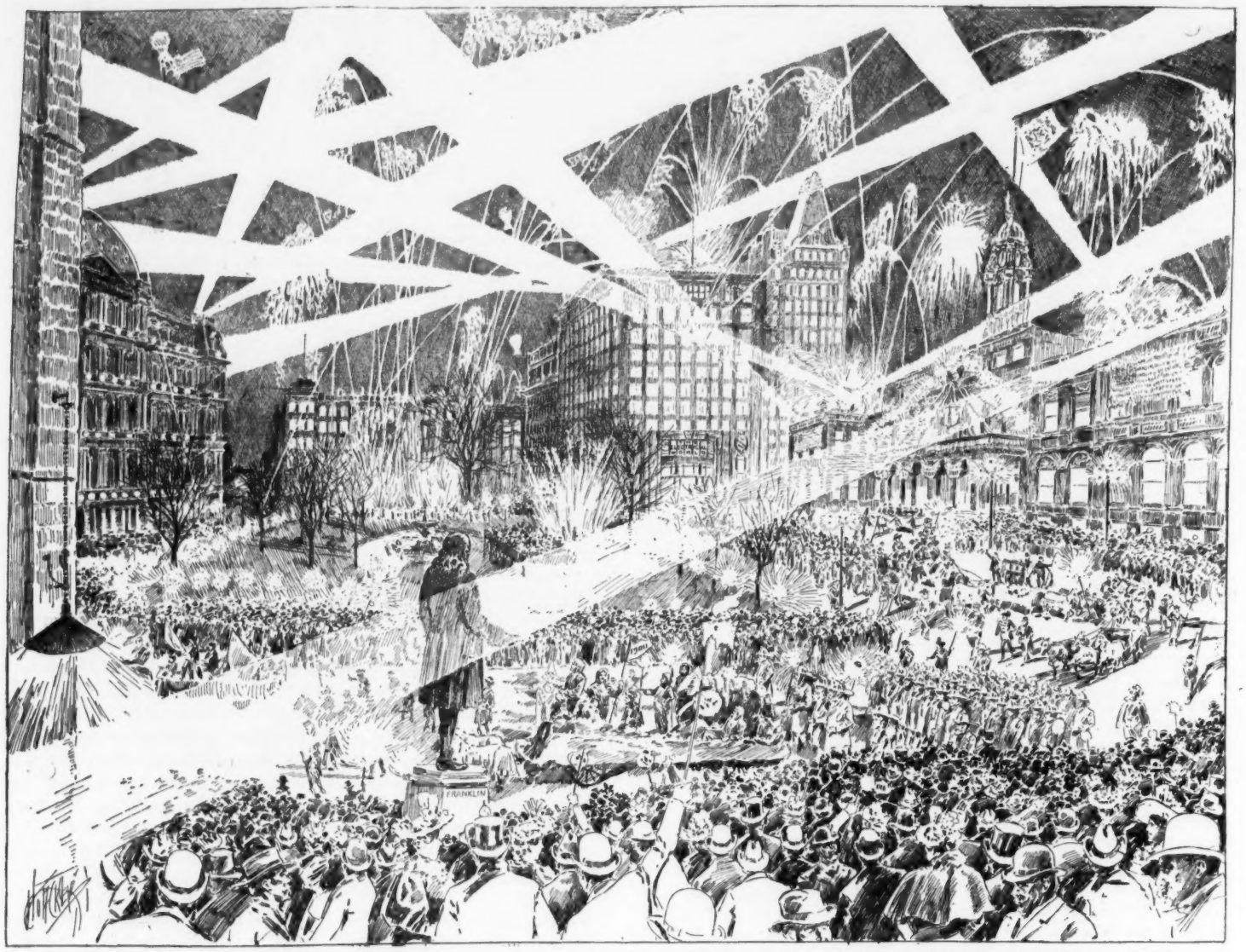
At midnight on December 31, 1897, what is known as the Greater New York came within the corporate city limits. In line with its policy of creating as well as reporting news, the New York *Journal* engineered a celebration to suitably commemorate the event.

The centre of interest was in City Hall Square, the City Hall itself being the most prominent figure. The main feature of the celebration consisted in fireworks. The fixed illumination was almost entirely electrical, and was designed by the electrician in charge of the work of the newspaper, Mr. F. Schebe. The little park, which normally contains nine arc lights, was festooned with twenty-seven extra arcs, with brilliantly colored globes and brass mountings. Ten photo-engraving lamps, made by J. B. Colt & Co., were arranged in a row on the roof of an office building on Park Row, and focused upon the front of the City Hall. Five theatre balcony lamps and two criterion projecting lanterns were also arranged for ready manipulation to illuminate any desired point. Searchlights were also mounted, two being placed upon the roof of the Post Office, two on the City Hall, and others on the Postal Telegraph Building and the other office buildings surrounding the park. The front of the building occupied by the New York *Journal* was elaborately decorated with electrical signs and with fancy stars and borders of colored lights, some 800 incandescent lights being so used altogether. On the front of the City Hall itself, the General Electric Lamp Works placed five fancy colored figures, two of which were United States flags, two shields and one anchor. The flags were arranged with the well-known commutating device for imitating the waving effect. Streamers of incandescent lights were also run from the roof level up the flagstaffs.

The flag of the new City of New York was rolled up and confined in stops, as flags are arranged for unfurling on shipboard. The stop-rope was attached to a drum turned by a 1-hp motor, the circuit of which led through the contacts of a repeating sounder. This was controlled again by a main line circuit over the lines of the Postal Telegraph Company from San Francisco, and just at the instant of 9 o'clock P. M., San Francisco time, the Mayor of that city pressed the key, and thereby unfurled the flag of the Greater New York, thousands of miles away. This motion was the signal to the large force of men in charge of the fireworks, searchlights and projecting lanterns for the climax of the celebration.

The accompanying illustration, reproduced from the New York *Journal*, shows the effect of the illumination.

A procession, consisting largely of elaborately decorated floats, had been planned for the same evening, and was carried through in spite of the unfavorable weather. Several of the floats were elaborately decorated with rows of incandescent lights of different colors, the color effect being frequently shifted by switches. The harness of the many spans of horses hauling these large floats was also decorated with incandescent lights fed from the storage batteries on the floats behind.



Franklin on His Statue Must Have Been Impressed by the Electrical Effect in Front of The Electrical World Office.

Telephone Charges in Berlin.

The annual charge for telephone service in Berlin has been reduced from the equivalent of $37.50 to $12.50. To this is added a rate of 1 pfennig (about one-quarter of a cent) for each call by private parties; twice as much for business houses, and three times as much for clubs, cafés, etc. This differentiation of the various classes of business naturally has raised considerable opposition on the part of those charged the higher prices.

Digest of Current Electrical Literature American and Foreign.

by Carl Hering.

DYNAMOS, MOTORS AND TRANSFORMERS.

Alternator Tests. PARSHALL. Lond. *Elec. Eng.*, Dec. 17.—A reprint of a very long paper read at the Institution of Civil Engineers, containing a large number of curves and tables of results of the tests. The object of the investigation was to measure the efficiency of a large alternator at different loads, to obtain quantitative results regarding armature reaction and its effect on the field magnets, and on the form of the voltage curve, to subdivide and locate the elements of the total losses, and to establish an economical, accurate and comprehensive method of testing alternators. The efficiency of an alternator cannot be predicted from no-load trials; there is no armature reaction corresponding to that in direct current machines when the brushes are set symmetrically with respect to the polar projection, when the current and voltage are in phase; but when the current is displaced in phase from the voltage there is an action which in general corresponds to the angular lead of the collecting brushes in a continuous current machine; the local currents of double frequency which are set up in the field magnets tend to demagnetize these in case of a lagging current and increase the magnetism in case of a leading current. The Hopkinson method was used, two similar machines being rigidly connected by a coupling which admitted of the angular displacement of one armature relatively to the other by an amount which could be read in degrees, so that the phase difference between the machines was known; the power for driving the coupled machines was applied through a dynamometer. The results of the tests showed that when two similar machines are equally excited the phases of the current and voltage correspond closely with that of an alternator running on a non-inductive load, but the efficiency was determined under conditions corresponding both to a highly inductive load and to one having an appreciable capacity. A diagram of the connections is given; in the main circuit there were two complete sets of apparatus, the one consisting of an ampere-balance, a watt balance and an electrostatic voltmeter being the better one; the other was the interrupted contact set, consisting of a resistance, a contact disc and a quadrant electrometer; the first method is more practical and direct, while the second is susceptible of a greater refinement, and shows the nature of the curves; it entails greater labor, but should be used for a new type of machine for determining the general characteristics of the type. The machines tested were made by the (American) General Electric Co., and are to be installed in London. The output is 385 kilowatts, the speed 300 and the voltage 2200, there being 40 poles. The dynamometer was carefully designed and proved thoroughly reliable and very sensitive. The compression of springs was used to indicate the torque; the tests were made with the coupled and the uncoupled machines, and in the former case at various loads and various excitations; the results are given very fully, but no general conclusions are drawn; a table shows the total loss by induced currents in the field magnets when the two machines have different phase relations and have different currents, the results varying approximately as the squares of the current; from the results the curves of efficiency can be predicted with fair accuracy for this type of machine.

Starting Alternating-Current Single-Phase Induction Motors. ARNO. Lond. *Elec.*, Dec. 17.—A translation, with the diagrams, of the article, an abstract of which was given in THE ELECTRICAL WORLD, Dec. 11, p. 700. *L'Eclairage Elec.*, Dec. 11, publishes an abstract of the discussion of his paper, as read before the International Society of Electricians; in this he showed how to determine the critical value of the resistance of the elementary windings of the armature in order to give the most favorable conditions for starting. In reply to a remark by Korda he states that an initial start of one-sixth or one-eight of a revolution is sufficient; he experimented with the method suggested by Kando, and made a commutator the operation of which automatically short circuits a part of the armature during a very short interval of time after the circuit is closed; on a 25-hp motor he found that by the former method 250 amperes were required at starting, while with the new method only 110 amperes were used, this being nearly the normal current.

Diphase Laboratory Installation. HANAPPE. *L'Eclairage Elec.* Dec. 11 and 18.—A continuation of his very full description of the laboratory installation at the school at Mons, several installments of which have already been noticed in the *Digest;* he describes the stationary diphase transformers and the bi-polar di-phase motor, the description of the latter being very complete, covering 19 pages; a large number of curves, calculations and data are given.

Transformer Design. BERRY. Lond. *Lightning*, Dec. 16.—A short article in which he gives a table showing at a glance the divisions and subdivisions of the total losses in a transformer; the total loss is divided into the iron and copper losses, and each of these again into groups which are further subdivided when necessary; it is claimed that the application of such a table renders the work of designing, estimating, calculating, etc., transformers, much less laborious, and gives a comprehensive survey of the whole subject. In the brief accompanying article he states that for ordinary transformers used for the distribution of energy the average cooling surface for one of 15 to 30 killowatts should be 300 to 250 sq. in. per kw. output for the iron and 120 to 100 sq. in. for the copper, although few designs will admit such a large surface; the amounts of cooling surfaces for the iron and copper respectively should be about in the ratio of 2.5 to 1 for incandescent lighting under the general conditions. In transformers which are run continuously without sufficient ventilation, he states that the copper becomes quite brittle in the course of time.

Sparking; Its Cause and Effect. REID. *Elec. Rev.*, Dec. 22 and 29; *Elty*, Dec. 22.—A reprint of his recent paper before the Amer. Inst. of Elec. Eng.

LIGHTS AND LIGHTING.

Enclosed Arc Lamps. WEDDING. *Elek. Zeit.*, Dec. 16.—A long article giving the results of extended photometric tests made with the Jandus enclosed lamp; the results are given in the form of a large number of curves and tables, showing the light intensity curve for the lower hemisphere; owing to the fact that the arc travels from one side to the other the measurements were made simultaneously from two opposite sides and the curves were combined; unless thus averaged the results are too irregular to be of any value; the mean hemispherical intensity in one case was found to be 158 candles, the mean voltage being 111.6 and the current 3.3 amperes, thus giving 2.33 watts per candle; these results are given for each case. Two lamps were tested, one for 3 and the other for 4 amperes; for the former the carbons were 10 mm in diameter, the length of the upper being 305 and for the lower 152 mm; for the 4 ampere lamp these figures were 13, 267 and 156 mm; they were not opened until the carbons needed to be renewed; the lamps were run for 4 hours and then cut out for one hour, but were continued through the night, thus imitating the conditions in practice; the life was, therefore, less than if they had been run continuously. From the mean curve it appears that the direction of the maximum light was less inclined to the horizontal than in the usual lamps; moreover, from this direction to the horizontal the diminution was less rapid than in the ordinary lamps; this distribution of the light is therefore, more favorable for lighting an area, as the illumination below the lamp is more uniform. The specific consumption for a three ampere lamp averages 2.90 watts per candle and for the 4 ampere lamp 2.81. The 3 ampere lamp ran 92 hours, and the 4 ampere lamp 95¼; in the 3 ampere lamp the consumption was 2.4 mm of carbon per hour, and in the 4 ampere lamp, 1.8 mm. The complete spherical intensity was also measured for the 4 ampere lamp, and the results are given; they show that the distribution of the light is more favorable than for the ordinary arcs, as there is relatively more light in the upper hemisphere, the amount below the horizontal line being about two-thirds of the whole; this is more favorable for internal illumination, as it throws more light to the ceiling, but in this respect it is less favorable for external illumination. He then calls attention to the various costs of operation as compared with the ordinary lamp, using for comparison an ordinary 6 ampere lamp with an opal globe, the lamp containing the "well-known" stone block around the upper carbon, which diminishes its consumption by decreasing the air currents. The absorption of the globe was found to be 30 per cent.; the curves are given; the mean hemispherical intensity is 171 candles, including the energy lost in the external resistance necessary for running from a constant potential circuit; the efficiency was 1.83 watts per candle; the efficiencies, using the 3 ampere Jandus lamp are, therefore, as 2.90 to 1.83 in favor of the ordinary lamp; if the ordinary lamp had been run with a higher voltage the results would be still more favorable, the efficiency in that case being 1.27 watts; the life was about 12 hours, and the carbons must, therefore, be changed seven times for every one change in the enclosed lamp; there are eight times as many carbon stumps; the greater price of the carbons and attendance is quite appreciable; the liability of globes breaking is greater for the Jandus lamp; no actual figures are given; he concludes by giving the advantages and disadvantages of each, all of which are well known; the light intensity of two ordinary lamps in series corresponding to about the same consumption of current and voltage is greater than for the single enclosed lamp, the efficiency also being greater.

Enclosed Arc Lamps. MARKS. *Elec. Eng.*, Dec. 30.—A reprint of his discussion at the Amer. Inst. E. E. of the recent paper by Friedman, Burroughs and Rapaport.

POWER.

Electric Elevators and Cranes.—Lond. *Elec.*, Dec. 17.—The conclusion of the long discussion of Ravenshaw's recent paper (see *Digest* last week). Preece gave data concerning three elevators at

the post office at Leeds, with which careful and accurate experiments were made; the table gives the load, the travel, time, power, energy and cost of working; the latter is almost exactly $35 per elevator per year. At the London post office there are several hydraulic elevators for which he gives the data; the mean cost per elevator for equal loads and heights is $175 per year for the hydraulic, as against $35 for the electric; the electric power is developed on the premises. Regarding the staff, it was only a difference between a skilled mechanic and a skilled electrician, the latter, if anything, requiring less training; whatever could be done with the storage of hydraulic power could also be obtained by the storage of electric power. Ravenshaw in his reply answered some of the remarks. Concerning the cost of a generating plant, he said it was about 25 per cent. greater for the electric than for the hydraulic system; the repairs and maintenance of electric motors should not exceed 5 per cent. per annum; the power would cost about $42 per brake hp per year at the shaft of the electric motor. In a long communicated discussion Aspinall cited the case at Harwich, which was a good illustration of the advantages of electric overhead cranes instead of ropes; formerly there were 20 cranes of 30 tons each in this shop driven by ropes, and now there was a single motor with each crane, which results very advantageously. Cotton advocated a self-holding worm gear as against one with a quick pitch; he thinks if the hydraulic pressure is 700 pounds per sq. in., the hydraulic elevator is the better; he gives some curves showing the energy consumed for hydraulic and electric elevators, which is in favor of the former; with no load the difference is 20 per cent., and at the best efficiency the consumption of energy was double that of the hydraulic elevators. Scott called attention to the use of the duplex worm gear, in which there is no end thrust; the general practice is to reverse the field magnet current; he shows a system of reverse coils which are thrown into circuit whenever the field circuit was cut off; these provide a path for the induced curent, which is very effective in reducing the residual magnetism; he then describes and illustrates an arrangement designed by him in which the motor is at the bottom of the car, and operates two nuts on two quick pitch screws which run the whole length of the elevator shaft in diagonal corners of the elevators. Tabscott favored the use of gearing in preference to the multiplication of the electrical appliances in the three motor arrangement. Thorpe claimed that a shunt motor with a few series turns was not enough to give the large starting torque required, as it requires double the normal current; the starting torque should be at least double the running torque; a good worm gear has a very good efficiency if the pitch is quick enough; he mentions a system which gave ideal results in respect to starting and stopping (which resembles the well-known Leonard system), but the drawback is the extra generator. Webb gives some figures regarding the traveling cranes at the Crewe works, where there were fifty-three in use, originally constructed for rope driving; these were replaced with encouraging results with an independent electric motor for each of the three movements; the magnets are energized three in series, from a circuit which is never broken, the current being about one ampere; some data for these cranes are given; the cost of repairs has been very small. Ravenshaw in his final reply did not favor the use of a slow pitch worm; he had experienced no difficulty in the use of magnetic brakes; he thinks the device of Scott would be very expensive, and would have a low efficiency.

Long-Distance Transmission. Ritter. *L'Elec.*, Dec. 11.—A short description of a plant in which lighting currents are transmitted to a distance of 36 miles from Montboven to Estabayer; 1000 horse-power obtained from a 6000-hp water power in the former place is used, but how much of it is transmitted is not stated. For the long distance transmission three transformers are connected with their primaries in parallel to the 4000 volt circuit; the secondaries are connected in series, each one generating 4000 volts each, making a total of 12,000; but there are also two wires from the junctions, making a four wire system with 4000 volts between each pair; the advantage of this system is claimed to be that there is no more than 4000 volts between any two parts of the same transformer; the disadvantage is that there are four wires instead of two, but two of these can be made quite small if the circuits are well balanced. Another system which it is thought would have been preferable is described and illustrated; it consists in connecting the two primaries of two step-up transformers in series with each other; there will, therefore, be 2000 volts at the terminals of each; their junction it appears is connected to earth; each secondary coil is connected to a separate pair of wires and generates 4000 volts; it appears from the description, although the drawing does not seem to be quite correct, that one terminal of each secondary is connected with the corresponding terminal of the dynamo, the result being that there will be 4000 volts between one wire of one of the secondaries and one wire of the other, thus making a four wire system as before, with a total of 12,000 volts, or 4000 between each two wires. The advantage claimed is the reduction in the first cost, because for every kilowatt used the transforming apparatus need develop only two-thirds of a kilowatt, as one-third is obtained directly from the original circuit without transformation.

Gas Engine Stations.—Lond. *Elec.*, Dec. 17.—A long abstract of the report of Robinson on the Leyton station which was noticed in the *Digest*, last week; also an illustrated description of the Leicester plant of the Midland Railway, which is said to be one of the most successful of the few gas engine stations in that country. In an editorial on this subject it is stated that the immediate prospects appear to be that no radical improvements in gas engine practice will be introduced which might place the present practice on a different footing; it is thought that the modern gas engine has amply justified its existence in stations of small capacity, but it is not thought that the gas engine as at present designed shows any commercial advantage over the use of steam power, for stations of a large size; large gas engines are more economical than small ones, but in nothing like the same proportion in which a large steam engine is less wasteful than a small one, and the practical limits of size and power are much lower for the gas engine than for its rival. A reprint of portions of Robinson's report on the Leyton gas driven plant is reprinted in *El'ty* (N. Y.), Dec. 29, the table of data showing the monthly fuel consumption and the results of tests are reproducted.

Floating Water Motor.—Elek. Anz., Dec. 12.—An article supplementary to the descriptive one noticed in the *Digest*, Aug. 28 and Oct. 16. The present one gives estimates of the first cost and cost of operation of such a motor; the calculations are made for a stream 10 metres wide and 1 metre deep, the fall of which is 1 in 1000; the theoretical horse-power is 80 and the electrical 40; the first cost, including the dynamo, is about $3250, and the yearly operating cost, including interest and amortization, $900; the cost per electrical horse-power per year is therefore $22.05; together with a battery of accumulators, which would be required if the stream is navigable, the first cost would be $8500, and the cost of operation, $2050; the cost per kw hour of electrical energy is therefore slightly less than one cent. As motors can be run with acetylene from calcium carbide, it is claimed that the latter material is an excellent means for storing energy for an indefinite period of time.

Ventilating Fans. Walker. Lond. *Engineering*, Dec. 17.—A reprint of a supplementary paper to the one which he recently read.

Power in Mines. McMurtrie. *Sc. Am. Sup.*, Jan. 1.—A reprint of a prize essay from the *Iron and Coal Trades Review*, in which he compares the advantages and disadvantages of steam, compressed air and electricity for power purposes in coal working, with special reference to coal cutting and coal haulage. His conclusions are that probably rope haulage by steam engine at the surface or below, is more economical than either compressed air or electricity, yet when extensions of the system of haulage are to be made requiring subsidiary engines, electricity and compressed air should be used; of these two electricity is to be preferred, on account of its greater efficiency and reduced first cost; electricity should be adopted for both pumping and coal cutting.

Alternating-Current Patent.—El'ty, Dec. 29.—A reproduction of the illustration and the claims of the Hunter patent, which is claimed to control the whole field of the transmission of power by alternating currents. The claims are also reproduced in *Elec. Eng.*, Dec. 30.

TRACTION.

Accumulator Traction. Ayrton. Lond. *Elec. Rev.*, Dec. 17.—A short article correcting the report of his discussion of Epstein's recent paper, where he was quoted as having said that it would require at least 4 horse-power to propel a 52 passenger car loaded, at 8 miles an hour. Such a car weighs 8.5 tons, and at 33 pounds per ton it will require not less than 7.5 horse-power at the wheels for 10 miles an hour, the electrical power furnished being, therefore, about 11 horse-power. He calculates the watt hours per pound of gross weight of traction from the information in the catalogues of accumulator makers, the results being given in a table; the highest is 11.8 for a 9 plate Lamina accumulator, a little over 10 for large E. P. S. and I. E. S. cells, and 7.2 for a large chloride cell; he does not think it safe to rely on more than 8 watt hours per pound gross weight, but takes 9 in his calculation; the 11 horse-power for 8 hours would, therefore, require about 5 tons of accumulators, making a total of 14 tons for the loaded car and the dummy containing the cells; a corrected calculation gives 5.4 tons of accumulators. He then compares this with what is done in Paris, where the 50 passenger car weighs 14 tons but the batteries only 3 tons, as it runs but 4 hours; it therefore agrees with his figures. He concludes that stating that the estimate of Epstein, 2.25 tons, would have to be more than doubled, is certainly not over-estimating the case.

Heilmann Locomotive.—L'Ind. Elec., Dec. 10.—A communication from the Heilmann Company criticising the assumption and conclusions unfavorable to this locomotive, which were made in that journal (see *Digest*, Dec. 18); some figures are given concerning the traction coefficient, based on the steam locomotive and the former Heilmann locomotive. This is followed by a reply of Hospitalier, in which he gives his authority for the traction coefficient which he assumed; he sees no reason why that figure, based on the experiments of Bousquet, should not be used; for the whole combination he estimates 9.16 kg per ton at a speed of 100 km per hour, and claims this to be a reliable figure, based on actual experience. He concludes that the performances of that locomotive will always be equaled, if not surpassed, by the compound steam locomotives, and that the high speed locomotives of the future will have a stationary central station, instead of carrying it with it. In a footnote he refers to experiments of Berbier, which were recently described, according to which it appears that the Heilmann locomotive would have to draw more than 206 tons of useful weight at a speed of more than 115 km per hour, in order to be superior in power and speed to the present locomotives used on the Northern Railway of France.

Lightning Express. Buse. *L'Elec.*, Dec. 11.—An article giving some general information on the high speed monorail system at Tervueren, near Brussels, sometimes known as the Behr system; it is favorable to the system; the Belgian Government is considering the construction of such a line between Antwerp and Brussels, and it is thought that in 1900 this distance will be covered in 20 minutes.

Classification of Vehicles. E. H. *L'Ind. Elec.*, Dec. 10.—A suggestion for the complete classification of all kinds of vehicles. The distinction is based on whether the wheels are used for carrying, for guiding, or for propelling; in the first general division there are, therefore, three general classes: first, ordinary carriages, to which belong all those which are pulled or pushed by an exterior force; the second, cycles and self-propelled carriages which carry their own motive power, and, therefore have wheels for directing, propelling and carrying; the third are railroad and railway vehicles which carry their own power, and run on tracks, therefore having no guide wheels. In a table these are again subdivided, showing also that some possible forms do not exist; he furthermore suggests adopting characteristic abbreviations for these different classes.

Electric Carriages. CLAUDE. *L'Ind. Elec.*, Dec. 10.—A correction of an error in his article, noticed in the *Digest*, Nov. 6.

Electric Locomotives at Steam R. R. Terminals.—Elec. Eng., Dec. 23.—An announcement that in the new Union Depot at Boston electric locomotives will probably be adopted for hauling trains into and out of the station for a distance of about a mile, over which no steam locomotives will be used.

Railway Booster.—Elec. Eng., Dec. 30.—A brief description of the two 50-kw boosters recently installed for some of the long feeder lines in Chicago; contrary to the usual practice, they are driven by a motor, which is thought to be more economical than a small high speed engine; a precaution used is to arrange a magnetic trip which will automatically open the circuit breakers in the booster feeders whenever the current for the booster motor fails; this is very important.

Canal Traction.—Elec. Eng., Dec. 23.—Brief, illustrated descriptions of the Shewring and the Leland systems. In the former the boat receives its current from a trolley wire which is so constructed that vessels may pass each other; in the latter there is a small locomotive on a slightly elevated track; the driving being accomplished by a rack and pinion.

Lemberg.—El'ty, Dec. 29.—A reprint of a brief descriptive article on this railway in Austria.

Electric Cab.—Elec. Rev., Dec. 29.—A brief, illustrated description from *Industries and Iron* of the Milde and Mondos cab.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Paris. Bos. Lond. *Elec. Rev.*, Dec. 17.—A translation of a brief summary of his very long report, which was noticed in the *Digest*, Nov. 20. It is a general report on the central stations in Paris, and a comparison with those elsewhere; in conclusion he favors the granting of the prolongation of the concessions asked for. Another article by Bos on the same subject, but apparently different from the report, is published in *L'Elec.*, Dec. 18; in it he also favors the prolongation of the franchises. *L'Energie Elec.*, Dec. 1, publishes abstracts of the report, including a map of the city, showing the districts covered by the various central stations.

Fire Risk in Power Installations. TAYLOR. Lond. *Elec. Rev.*, Dec. 17.—A reprint of a long paper read before an insurance society. He argues that the fire risk incidental to the use of electricity for lighting is relatively slight, his experience being based on seventeen years' practice; but it is very necessary that proper rules should be followed. He quotes from the Phœnix rules; he recommends a precaution in the form of a fireproof covering for hazardously situated motors, or the use of self-enclosed motors. He quotes largely from American sources, giving some typical instances of fires originating from motors or dynamos, and admitting that American experience has been very wide; some opinions collected by the Boston *Standard* are also quoted.

Central Station Records.—Lond. *Elec. Eng.*, Dec. 17.—Answers to a request to give the best form of blanks which should be filled out each day to show the results of the day's working.

The Meter Question. THAYER. *Elec. Eng.*, Dec. 23.—A short article favoring a modified flat rate system. The margin of profit on the flat rates is more constant than on the meter rates; some of the disadvantages of this system were overcome by a method used by him; he charged flat rates of 60 cents per month per lamp, but if there are some lamps not used frequently, he charges 33 cents per month for the lamps burning during the hours of maximum load, and 5 cents per kw hour for all current taken; it is based on a 3.3 watt lamp; the meter charge of a quarter of a cent an hour is a sufficient incentive for the economic use of the current; a table gives the estimated revenue to be derived from such a system of rates; the experience of nearly a year has been satisfactory.

Municipal Control. BOWKER; COMMONS. *Municipal Affairs*, Dec.—Two articles, the first on "Public Control, Ownership or Operation of Municipal Franchises," with special reference to electric lighting, the author, Bowker, being the executive of the New York Edison Co.; it is not favorable to municipal ownership. In the second, by Commons, on "Municipal Electric Lighting," he favors municipal ownership, giving his reasons.

Municipal Ownership.—Elec. Eng., Dec. 23.—A short article by Fitz Gerald on municipal lighting ownership from the stockholders' standpoint, and another which is a short report by Emmons on the Rock Falls Hill (Ill.) plant. Several notes on the subject of municipal affairs are also given in the issue of Dec. 30.

Large Private Plant.—Elec. Eng., Dec. 30.—A long, well illustrated description of the electrical equipment of the American Lithographic Company's building in New York City, where electricity is used for lighting and power purposes.

Bradford.—Sc. Am. Sup., Jan. 1.—An illustration, with a brief description, of one of the large direct connected units for the Bradford (England) station, which was recently referred to in the *Digest.*

WIRES, WIRING AND CONDUITS.

Alloys of Nickel and Steel. GUILLAUME. *L'Eclairage Elec.*, Dec. 11.—An abstract of his recent paper read before the International Society of Electricians. He made extended experiments to investigate the physical properties of nickel steels, including also some of the electrical properties; he showed that a mixture of the two metals gives new combinations having properties which are quite different from those of the two metals; nickel steel, for instance, having 20 per cent. of nickel is not magnetic at the ordinary temperatures, while nickel and steel both are; he made experiments with with 39 samples made specially for this purpose, each having a different proportion, the quantity of material used being more than a ton, thus giving a good basis for reliable results; the results are to be published in that journal at some future time.

Electrical Conduits and Cables. DOW. *Eng. News*, Dec. 30.—A reprint of a long paper read before the Detroit Engineering Society; it is well spoken of editorially. After giving a brief history he describes the practice of the present day and gives the reason for such practice.

Wire. ORTON. *Sc. Am. Sup.*, Jan. 1.—A reprint of a short article of a general character on wire and its manufacture, reprinted from the *Sibley Journal of Engineering.*

ELECTRO-PHYSICS AND MAGNETISM.

Röntgen Rays. SWINTON. Lond. *Elec. Rev.*, Dec. 17.—A brief abstract of a recent paper read before the Röntgen Society. He describes his well-known adjustable tube in which the distance between the cathode and the anti-cathode is varied; another improvement is that the platinum anti-cathode is kept cool by being fixed in contact with a block of aluminium; there is no advantage in using very large cathode discs, the size depending on the coil used, being larger when the coil is larger; for ordinary uses 1⅛ inch diameter and ¾ inch radius of curvature are best; the glass should be the thinnest that will stand the atmospheric pressure, and the cathode disc should be turned in a lathe; the photographic quality of the rays cannot be determined by means of the screen. The question arose whether a coil or an influence machine gave the best results; Wimshurst claimed that his machine gave the best results; it is generally conceded that the image was steadier on the photographic screen than when a coil was used; Swinton thought the oscillations were more rapid with the machine.

Dissemination of X-Rays. BUGUET. *L'Ind. Elec.*, Dec. 10.—A reprint of an academy note. The cause of failure of radiographs he claims is often due to the return of the rays from the backs of the plates; he made an experiment to demonstrate the effect of these return rays directly, and showed a means of overcoming it. He made a radiograph of a watch on a plate, half of the back of which was covered with a sheet of lead; the exposure was two minutes; the part which was not protected by the lead was covered with a haziness which almost completely obliterated the photograph, while the part over the lead was very sharp; two radiographs of the watch were made under like conditions, but in one case there was a lead plate below the photographic plate, and in the other case there was not, and the difference in the sharpness was quite apparent. Such protecting screens are not necessary with short exposures and very penetrating tubes, but they become necessary for long exposures; in surgical applications the radiographs also show more detail, even for short exposures.

X-Rays. KARNOJITSKY and GATLITZINE. *L'Eclairage Elec.*, Dec. 11.—Brief abstracts of two papers read before the Russian Physical Chemical Society. In one they endeavor to determine the point of emission of the rays by photographing a plate with nails, from the shadows of which they found their origin of the rays; this was found to be inside of the tube, not far from the walls; ordinarily there are two points of emission, one corresponding to the cathode, and the other, less intense, to the anode; generally the former is in front of the cathode disc several millimetres from the internal surface of the tube; sometimes, especially when the electrode is cylindrical, it is near the cathode. In the second paper on the polarization of X-rays they photographed three plates of tourmaline in different positions, obtaining impressions of different intensities; they believe it proves definitely that these rays are susceptible to polarization.

Electrical Properties of Crookes Tubes. STCHEGLAIEFF. *L'Eclairage Elec.*, Dec. 11.—A brief abstract of a paper read before the Russian Physical Chemical Society. He made researches with the electric field of such tubes by means of an insulated zinc plate connected to the ground through a galvanometer; when placed in the free field of the cathode the galvanometer showed a negative current, that is from the earth to the plate; when the current was reversed in the tube there was no current in the other circuit; the intensity of the current is inversely proportional to the distance of the plate from the cathode; a conducting body placed between the tube and a zinc plate diminished the action, and even changed the direction. The observations agree well with the hypothesis of radial currents in the field of a tube, as proposed by Boltzmann. The

photographic action of Röntgen rays appears to be an electrical phenomenon; with two plates having two gelatine sides toward each other separated by a thin layer of air, he found under favorable conditions that there was a negative image on the first plate and a positive one on the second.

Propagation of X-Rays. Sagnac. *L'Eclairage Elec.*, Dec. 18.—A long article reviewing recent researches, with a view to compare the properties of these rays with those of ultra-violet rays of extremely short wave lengths; it appears that the hypothesis based on this comparison will explain all facts known at present.

Crookes Tubes. Machado. *L'Eclairage Elec.*, Dec. 18.—A re print of an Academy note. When the Ruhmkorff coil discharge is passed through a tube with an aluminium cross at the end of the anode the following facts were observed: On the walls of the anti-cathode there is besides the shadow of the cross another shadow, the existence of which has not before been noticed; it is in the form of a circle, the diameter of which is less than the total length "of the two vertical opposed branches of the cross;" when the magnet is approached the two shadows are deflected, the circular one much more than the other, tending to place itself at 90° with the magnetic field; this circular shadow appears to be the largest base of a truncated cone, of which the smaller is the cathode disc; it appears probable that the space included by this cone is devoid of all useful radiations.

Electric Conductivity of Discontinuous Substances in Connection with Wireless Telegraphy. Branly. *L'Eclairage Elec.*, Dec. 18.—A short Academy paper. He repeated his former researches for determining the conditions which increase the sensitiveness of coherers, and found that his former results were confirmed; the substances which are most sensitive are those which have a very small conductivity; he also experimented with metallic powders coated with insulating materials, and united by fusion; the properties of these were found to be the same as those of metallic powders; the sensitiveness is quite great, being equal and even superior to that of the most sensitive powders. In connection with the current which traverses these substances he says that the intensity of this current is an important factor; marked results are produced if the E. M. F. is reduced to 0.05 to 0.01 volt, or by using thermo-electric currents, but he does not state what these results are. He adds that it is possible to obtain mixtures which are conductors only for an instant and return immediately without a mechanical shock to their original resistance; this can even be done with any materials by suitable manipulation; nothing further is said about this.

Attenuation of Electric Waves Along Wires, and Their Reflection at the Oscillator. Barton. *Proc. Lond. Phys. Soc.*, Nov.—The beginning of a reprint of the Physical Society paper which was noticed in the *Digest*, Sept. 4.

Resistance of Salt Solutions in Motion. Bosi. *L'Eclairage Elec.*, Dec. 11.—A long abstract from the Italian of a paper which has already been noticed in the *Digest;* he describes researches showing in general that a movement of the liquid modifies the resistance, though only slightly.

Electromagnetic Theory. Heaviside. Lond. *Elec.*, Dec. 17.—The 101st installment of his long serial, forming a portion of Vol. 2 of the author's work on this subject; it is highly mathematical in character.

Solar Heat Radiation. Crova. *L'Ind. Elec.*, Dec. 10.—A reprint of an Academy paper describing his new thermo-electro actinograph, with which he measured the heat radiation from the sun.

Calculation of Alternating Currents. Janet. *L'Eclairage Elec.*, Dec. 18.—A short article on the application of what he calls imaginary quantities to the calculation of alternating currents Representing a vector quantity by the expression which he calls the imaginary quantity, he obtains simple expressions for the power and for the Ohm law relation.

Magnetic Shielding of Conductors. Wilson. Lond. *Elec.*, Dec. 17.—An article describing and giving the results of some experiments which he was led to make when engaged in the subject of the transmission of force by a rotating magnetic field and an armature carrying conductors threaded through holes near the surface; the object was to get a practical demonstration of the disturbances to be dealt with under different conditions. An electromagnet was provided with an armature through which was passed a cross magnetizing coil, whose axis was perpendicular to the lines of force; the armature also contained holes near the polar surface, through which loops are passed; there was also an air gap in which the induction was measured. The tests seem to have been carefully made, and the results are given, but it does not appear that any general conclusions are drawn. The experiments are not intended to throw any light on the way in which the force is transmitted, but there are one or two points of interest which he discusses.

Theory of Magnetism. Rosing. *L'Eclairage Elec.*, Dec. 11.—A very brief abstract of a paper read before the Russian Physical Chemical Society. He suggests a dynamic theory of magnetism based on the hypothesis "of the magnetic movement of the material;" in considering the hypothesis that magnetic flux is a movement of ether along the lines of induction it is possible to explain the magnetization of a material by the phenomena of reflection of the flux by the molecules, the reflection being with or without a change of sign and intensity, according to the material.

Demagnetizing Watches. Poncin. Lond. *Elec. Rev.*, Dec. 17.—He describes a method which has been used with success for many years. The watch is hung by a string which is twisted, the watch being near a magnet or dynamo; while it is revolving it is gradually moved away from the latter. (The method is believed to be well known.)

Locating Bullets.—Sc. Am. Sup., Dec. 25.—A well-illustrated description of the apparatus of Contremoulins and its application, which is used in France; he claims it to be capable of revealing with absolute precision to a half a millimeter the exact location of a ball in the brain; it was successfully used in two cases. The principle is briefly that with the aid of two radiographic proofs obtained at different times the centre of the bullet is determined by a geometric construction, by its relation to three fixed points traced on the face of the patient; the apparatus consists of a framework surrounding the head and containing various adjustable points; also two tubes and the photographic plates. By means of the movable arms the extremities of one of them will indicate exactly the centre of the ball; it is therefore only necessary to follow the direction indicated by this arm, and to penetrate to the depth indicated by its length.

Röntgen-Ray Notes. Rolins. *Elec. Rev.*, Dec. 29.—A few further notes. Among other reasons why the vacuum rises, he states that particles of aluminum from the cathode are so heated that they combine with the oxygen of the original gases; another cause is the cracking of the glass fused around the platinum wire. He shows why the definition of the reflecting focus tube is better in one plane than in another; the shape of the beam on the target is oval and not circular, therefore for the best definition the target should not be at an angle of 45°; the oval figure should be seen at such an angle, so that its length is reduced. The reflecting platinum anode tube in one of its modified forms is now practically the only kind used; the original tubes in which the source is on the glass are no longer practical.

Switch for X-Ray Work. Willyoung. *Elec. Eng.*, Dec. 30.—An illustrated description of his switch, which accomplishes the same purpose as that recently described by Kolle, and will do more; the current may be reversed, and there is no danger of closing both circuits too nearly together.

Röntgen Society.—Elec. Rev., Dec. 29.—A reprint of the brief report of the meeting, noticed in the *Digest*, Dec. 11.

Carbon Detector for Hertz Waves. Jervis-Smith. *Elec. Eng.*, Dec. 30.—A reprint of the article abstracted in the *Digest*, Dec. 4.

Magnetarium.—Elec. Eng., Dec. 23.—A brief, illustrated description of the Wilde apparatus, mentioned in the *Digest*, Nov. 6.

ELECTRO-CHEMISTRY AND BATTERIES.

Depolarization of Electrodes. Klein. *Proc. Lond. Phys. Soc.*, Nov.; abstracted from the *Wied. Ann.*, 62, p. 2.—He investigated the disappearance of polarization after the circuit of a cell has been broken; one of the electrodes was very small, and the other 100 to 300 times as large, each being alternately made the anode and cathode, the electrodes being platinum or mercury. No effect of the size of the electrodes was perceptible; a greater exposure to the polarizing current is followed by retardation of polarization; the cathode depolarizes more rapidly than the anode; the nature of the electrolyte is of small importance, but mercury in most cases depolarizes more quickly than platinum; the depolarization is increased by adding a small quantity of the salt of the electrode metal having the same acid as the electrolyte. He attempts to explains his observations on the basis of Warburg's induction current theory.

Electro-Deposition of Gold. Andreoli. *L'Elec.*, Dec. 18.—A brief description of the Siemens process, which it appears is now used with great success in the Transvaal; it is used even for extracting the ore from the tailings and slimes, which were formerly abandoned. In an editorial note it is stated that that company is about to use Andreoli's modification, in which the gold is deposited on iron from which it is dissolved by immersion in fused lead; the anodes are insoluble; his process has already been described in the *Digest.*

Accumulator Plate. Riley system. Lond. *Engineering*, Dec. 17.—A brief, illustrated description of the plate and the way it is made. A network of steel or iron wires is placed on each side of a lead plate, and the whole is submitted to great pressure, which forces the wires into the lead, which then partly closes over them; the iron wires are then dissolved by means of acids; such a plate can either be formed electrolytically, or can be pasted with the active material.

Coal Gas Element. Borchers. *Elec. Eng.*, Dec 23 and 30.—A translation, apparently in full, of the article noticed in the *Digest*, Dec. 11, the original of which was abstracted Aug. 21; see also Sept. 18.

Obtaining Nickel from Its Ores.—El'ty, Dec. 29.—A reprint of the article noticed in the *Digest* last week.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Differential Telephone for Resistance Measurements. Federico. *L'Eclairage Elec.*, Dec. 18.—A long abstract of an article from the *Nuovo Cimento*, Sept.—The method usually used for the measuring resistance of polarizable electrolytes is the telephone method of Kohlrausch, but with this it is not possible to get the minimum sound in the telephone well defined; the present writer, therefore, devised a differential telephone method which is more exact, and can be used equally well for high and low resistances; it is analogous to the differential galvanometer for measuring a metallic resistance. The telephone itself consists of two cores and coils, one on each side of the diaphragm; the two coils should be as nearly identical as

possible in resistance, length of wire, coefficient of self-induction, etc.; he obtains the alternating current by means of a vibrating cord operated by a magnet and actuating a mercury interrupter; by varying the tension of the cord the frequency can be adjusted. Two circuits lead from the source of current, one containing the resistance to be measured and one of the telephone coils, and the second circuit a known resistance and the other coil; the direction of the currents is such that they act on the diaphragm in opposite directions; the telephone is adjusted by moving one of the cords, so that when the unknown resistance is replaced by one equal to the other known one complete silence is obtained; in making the measurement the known resistance is varied until it balances the unknown; it is not easy, however, to obtain complete silence; the tension on the vibrating string should be such that the vibrations are in unison with those of the diaphragm; although it is difficult to obtain complete silence, yet the minimum sound is sharply defined and easy to adjust to; the precision of this method is greater than that obtained by the Kohlrausch method, and is about 1 in 1000; the resistance of the telephone coils should be adapted to the resistance to be measured, thus for less than 10 ohms the resistance of the coils should be about 1 ohm; for up to 100 ohms it should be 10 ohms, and above 100 ohms, 75 ohms; for measuring resistances greater than 50 ohms the induction coil should be used as the source of current; for very high resistances liquid resistances should be used, the form of which he describes.

Measuring Rail Joint Resistances. WALMSLEY. *Elec. Eng.*, Dec. 23.—A brief description of a simple system proposed by him. There is a millivoltmeter with two independent pointers actuated by independent solenoids, both reading on the same scale; one circuit on the rail across the point; the other circuit is also attached to two brushes, the distance between which on the unjointed rail can be varied until the two pointers read alike, the difference of potential being caused by the current flowing through the rail; the resistance of the joint is then found in terms of a certain length and the solid rail; the current being the same in both portions it can be ignored, but the drops in volts may be found by measuring the drop in various sections of rail per foot at the station with a known current.

Use of the Telephone as a Galvanoscope. HANCHETT. *Elec. Eng.*, Dec. 23.—An article in which he calls attention to the advantages of the telephone in the place of a galvanometer for measuring purposes, which he believes have not been fully realized. It is limited to what are known as the zero methods (frequent references to this use have been given in the *Digest*). It is important that the interrupter should make contact at a certain definite period, so as to be able to distinguish between spurious currents and the measuring current; he recommends driving the interrupter by clockwork, and describes a simple way of doing this; he then describes the application of the telephone to some of the most common cases, giving illustrations of the connections for the calibration of a voltmeter and for taking the curves of alternating currents; he recommends its use in the railway repair shop or factory, and suggests a method for making a simple non-inductive resistance of high value, consisting of a glass tube filled with water.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—Lond. *Elec. Eng.*, Dec. 17.—A brief account of Slaby's experiments in Berlin, which have already been referred to. He states, among other things, that the distance of the transmission depends upon the length of the receiving wires; the difference between a clear and a vitiated atmosphere is as much as 100 per cent.; to communicate between Dover and Calais the wire would have to be 240 feet long, and for connection with America 6000 feet would be required; it is questionable, however, whether such a distance is possible, as there is no experience to show the relation between the electric waves and the curvature of the earth; it seems that the waves go in straight lines, but this may be only apparent.

Wireleless Telegraphy.—Lond. *Elec.*, Dec. 17.—An editorial note pointing out that Slaby in his recent demonstrations in Germany succeeded in signalling about 13 miles without any single detail that originated with Marconi, although it seems that he was under the impression that he was using the Marconi system; it seems that he really showed that success is not necessarily dependent upon anything that Marconi originated.

Wireless Telegraphy.--Elek. Zeit., Dec. 16.—A brief communication giving a diagram of connections of an arrangement which is said to be simple and require less attention; very good results are said to have been obtained with it; it does not admit of being abstracted.

Telegraphing Without Wires.—Elec. Age, Dec. 25.—An illustrated description of the apparatus of Clarke, which was recently exhibited in New York.

Spark Telegraphy. SLABY. *El'ty*, Dec. 29.—A reprint of the brief report of his Berlin experiments, noticed in the *Digest*, Dec. 11.

Telautograph System.—Elec. Eng., Dec. 23.—A brief description of the Hummel system which was recently tested by sending a "photograph" over wires "with remarkable accuracy," the distance being 320 miles. The description is very brief, but the apparatus seems to be based on the well-known principle of two stiles moving synchronously across the picture and receiving blank respectively, in close parallel lines; the improvements of the system must, therefore, lie in the details, which are not described.

Printing Telegraph.—Sc. Am., Jan. 1.—A reprint of the illustrated description of the telescriptor, noticed in the *Digest*, Nov. 27.

Fire Alarm Cable.—Sc. Am., Jan. 1.—An illustrated description of a wire which is to replace the thermostats; the wire itself contains besides the copper conductor, an easily melted metal fuse; the heat of a lighted match is sufficient to melt the fuse, and thereby ring an alarm; this wire may be strung along walls or ceiling; when cut it also rings an alarm.

MISCELLANEOUS.

Sterililing Water by Ozone. PIERARD. *L'Elec.*, Dec. 11.—A description of the system exhibited at the Brussels exhibition. It requires theoretically an expenditure of 258 kgm for producing 1 gram of ozone, and a kilowatt hour would, therefore, produce 1420 gr., but in practice only about one-tenth of this is obtained; the installation in question is not large enough to give any commercial figures; the alternator has a power of 8 kilowatts at 100 volts, and a frequency of 200; the voltage is raised to 35,000, or to 100,000, by means of transformers; there are in series with the discharge 15 resistances 60 cm long, consisting of tubes of glass filled with glycerine, in order to introduce a high resistance without a capacity, for producing a quiet discharge without sparks; one electrode is made of platinum plates, and the other consists of two plates of gold-plated copper, one on each side of the platinum, and connected to earth; a violet band of light is formed between the plates. There are five sets of apparatus or chambers; the air is first deprived of dust and dried, after which it passes through the five chambers in series, being cooled between each two chambers by means of tubes through which cold air is passed; in the sterilizer containing the water the ozonized air is passed up from the bottom in the form of small bubbles; the water also circulates from the bottom to the top, the amount of circulation depending on the amount of contamination; in another system the water is atomized in a chamber filled with ozonized air, thus making more intimate contact, in which case the percentage of ozone may be increased, whereby the operation is cheapened. The installation can treat 30 cu. m. of water per hour; it becomes absolutely sterile.

Potassic Iodide and Starch Paper. GRUETZNER. *Proc. Lond. Phys. Soc.*, NOV.—An abstract of a recent article in which he gives particulars concerning the best way of preparing such paper for electro-chemical markings. A smooth quality of white filter paper is soaked in a solution of potassic iodide and starch, and is then dried quickly in the dark; before being used it is dampened. The solution consists of 4 grams of wheat starch, 100 grams of water, in which 4 grams of potassic iodide is dissolved; as electrodes he uses brass rods pointed with iridium, the two wires being parallel to each other. The markings represent graphically the direction, strength and duration, as well as the growth and falling off of the current; some idea is also afforded of the nature of undulatory currents.

Westinghouse Works. GUNTON and LOMAS. Lond. *Elec. Rev.*, Dec. 17.—An illustrated description of the works of this company in Pittsburg.

Biographical.—Elek. Zeit., Dec. 9.—A short biographical sketch of Dr. J. Victor Wietlisbach, one of the leading telephone engineers in Europe, who died Nov. 26.

Biographical.—Zeit. f. Elektrochemie, Dec. 5.—Short biographical sketches, with portraits, of Bruno Kerl and Carl Schnabel, both of whom are metallurgists.

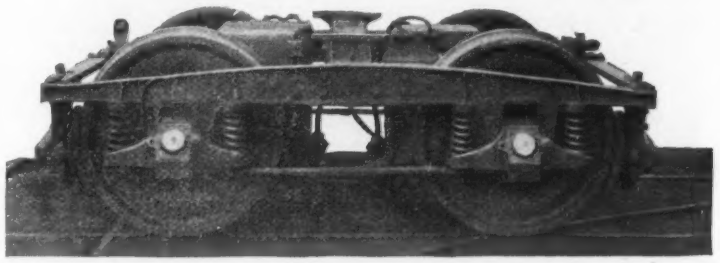
Sterilization of Water by Ozone. ANDREOLI. *Elec. Eng.*, Dec. 23.—A reprint of the article noticed in the *Digest*, Oct. 30.

Perchoid; an Insulating Material. HART. *Elec. Rev.*, Dec. 29.—A short article on this material, which appears to be perfectly oxidized oil, and is similar in some of its properties to india-rubber.

How to Become an Electrical Engineer. E. E. *Elec. Rev.*, Dec. 29.—The third prize contribution on this subject.

Electric Locomotive on the "Hoboken Shore Road."

On Tuesday, January 4, a party of invited guests were present at the trial trip of the new electric locomotive "No. 1" on the line of the Hoboken Railroad



SIDE VIEW OF ELECTRIC LOCOMOTIVE TRUCK.

Warehouse & Steamship Connecting Company, Hoboken, N. J., popularly known as the "Hoboken Shore Road." This locomotive will be used for switching purposes, and will take the place of the noisy drill engine.

The road runs from Seventeenth Street, Weehawken, to Fourth Street,

Hoboken, along the water front, or from the Erie tracks at Weehawken to the docks of the North German Lloyd Steamship Company, Hoboken, a distance of about 2 miles.

It was opened for traffic on September 20, 1897, and was constructed to provide connecting facilities between the tracks of the railroad companies entering Hoboken and the numerous warehouses and docks which line the west side of the North River, from Hoboken to Weehawken.

The locomotive was constructed in the shops of the General Electric Company, at Schenectady, N. Y. It is mounted on two four-wheel trucks, each axle carrying a General Electric 2000 motor, giving the locomotive a total of 540 rated horse-power. The weight on the drivers is 57,200 pounds; the drawbar pull is 10,000 pounds. The locomotive is driven through a single reduction gear of very high ratio. The speed is correspondingly low, and is rated at 8 miles an hour when hauling a heavy load. The cab is of iron and resembles a double steam locomotive cab, with a sloping tender shield at each end. On each shield is a headlight; in addition one shield carries a bell, the other a chime whistle. Beneath one of the shields are four packed card resistances, two sand boxes, the compressed air tank and the equalizing air tank; beneath the other, eight resistances, two sand boxes and the engineer's tool box. At one end of the cab is placed a controller of the series parallel type, known as the L-2. It contains the magnetic blow out, and is arranged to operate the motors either four in series or each two in series multiple. Beside the controller is the air-brake handle and the two valves of the sanding arrangement, by means of which the sand is blown by the compressed air under the wheels.

In front of the motorman is an air brake gauge and above it an ammeter, reading to 500 amperes. Fastened to the roof of the cab is an L automatic circuit breaker, set at 500 amperes. On the other side of the controller from the motorman is an M-circuit breaker and an automatic governor switch for the air pump placed at the other end of the cab. This is a single cylinder pump driven by a 3-hp iron-clad bipolar slow speed motor. The operation of this air pump is automatic.

The overhead wire is 00 suspended from wires strung between octagonal cedar poles, except at two or three points where bracket construction is used. The current is taken from the station of the Hudson Electric Light Company.

The Hoboken Shore Road is one of the sub-companies of the Hoboken Land & Improvement Company, organized fifty-two years ago, under a special charter, by the Stevens family, to consolidate their interests in their several Hoboken properties. The present head of the Stevens family, Colonel Stevens, is president, and Robert L. and Richard Stevens are respectively first and second vice-presidents; the general manager and treasurer is Palmer Campbell, and the secretary W. A. Macey.

General View of Electric Locomotive and Train on the Hoboken Shore Road.

Interior of the Cab.

High Voltage Glass Insulator.

While porcelain insulators are very largely used for high pressure electrical transmission lines, glass insulators have be no means been cast aside.

The illustration (Fig. 1) represents the patent triple petticoat glass insulator, made by Mr. Fred. M. Locke, Victor, N. Y., for pressures of 20,000 volts. This insulator is 5½ inches in diameter and 4½ inches high. Mr. Locke reports that he has just furnished over 30,000 of these insulators for power transmission lines in Califarnia, carrying potentials as high as 17,500 volts.

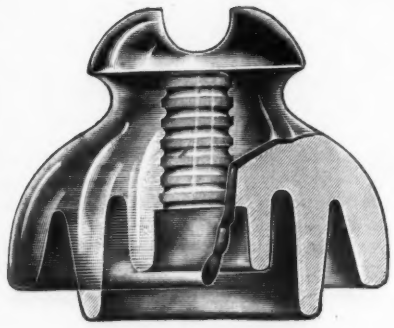


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 2 shows the steel pin with porcelain base, also manufactured by Mr. Locke, and Fig. 3 represents a four-pin upright side bracket, with indestructible pins, for attachment to the sides of buildings or similar places. The steel pin with porcelain base is designed for high voltage and other work.

Ground Detector and Polarity Indicator.

The accompanying diagram illustration shows the connections of the ground dectector and polarity indicator manufactured by Wood & Comer, Limited, Philadelphia, Pa. The object of this instrument is to locate a break or leakage on a line. The detector is connected up with one pole to the feed wire and the other to the ground. Should a leak exist on the line one of the platinum strips of the indicator turns red. If the strip thus affected is the one connected with the ground, it indicates that the leak is in the direction of the current beyond the point tested. If the strip connected with the feed wire turns red it indicates that the leak or break is between that point and the power station. This instrument is an infallible indicator, and is very useful for determining troubles in the manner above indicated.

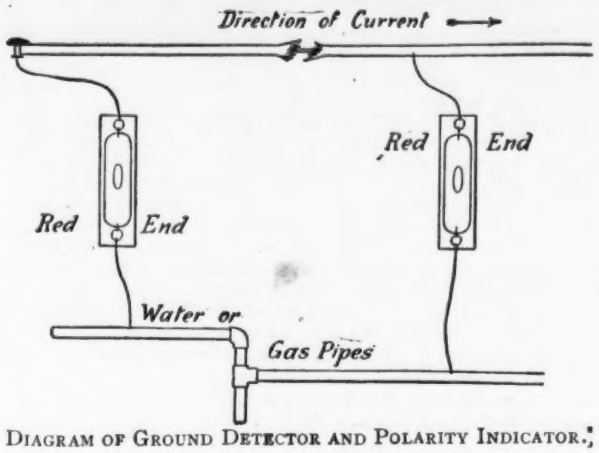


DIAGRAM OF GROUND DETECTOR AND POLARITY INDICATOR.

Combined Screw and Emergency Throttle and Boiler Valve.

From the early days of steam engineering it has been apparent that a very quick closing valve, which could be controlled from a distance, would prevent a large number of the accidents to which steam machinery is subject. In modern practice, which demands the use of very high pressures and high speeds in steam and electric power plants, such a valve becomes more and more a necessity.

The valve described herewith, with its attendant auxiliary means of control, is the invention of G. W. Brown, and was designed to fill the great demand for a practical, reliable emergency protection against accidents resulting from the bursting of a steam pipe, or fly wheel. It consists of a simple disc screw valve, to which has been added an emergency piston, which operates entirely independent of the screw and in no way interferes with its action. It can be controlled from a distance by automatic or manual means, to cause it to instantly close itself by steam pressure.

On the common form of valve body (Fig. 1) is bolted a cylinder, *A;* upon this cylinder is bolted the usual bonnet or cover which carries the screw and hand wheel. In the cylinder is a piston, *C*, provided with a loose-fitting ring, *H*, around which steam is permitted to leak. The trunk, *F*, also loosely fits a ring, *G*, and the screw stem, *S*, presses against the valve stem, but is not fastened to it, covering or closing the passage, *L*, when the main valve is open, also when closed by the hand wheel (Fig. 2). When closing the valve by the hand wheel, the spaces *M* and *N* being filled with steam, the valve simply acts as a screw valve, the pressure on the under side of the valve disc keeping the valve stem forced against the end of the screw, *S*.

To close the valve instantly it is only necessary to open the vent or relief pipe, *E*, by automatic or manual means, which takes the pressure off the under side of the piston, allowing the pressure on the top side of the same to force the valve to its seat. The piston having a much larger area than the valve, it has a large surplus of power to overcome any resistance of steam pressure against it. As long as the screw remains out, the steam passing through the hollow stem, *L*, maintains boiler pressure on the top of the piston and holds the valve shut; but it can be opened instantly by closing the vent, or relief pipe, and turning the screw in to close the passage *L*, then turning screw back.

The vent, or relief pipe, is a small iron or brass pipe, which may be extended to any part of the engine or boiler room, or outside of the same if desirable, and be provided with small screw or lever valves at convenient points, the opening of any one of which, by hand or other means, will cause the main valve to close by the emergency piston. The same principle is applied to the gate type of valve, as well as to the globe and angle types, but through somewhat different methods.

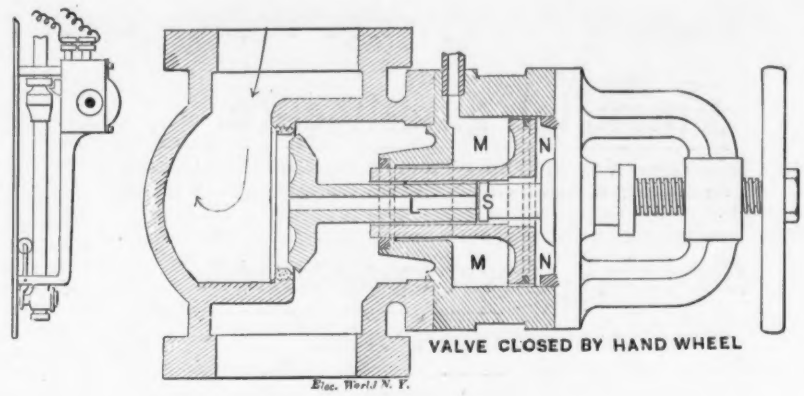


FIG. 2.

To guard the engine automatically against running away, the relief pipe is extended to a controller, which is provided with a small lever valve at the end of the relief pipe connection. A small weight sliding upon the same, in falling opens the relief valve, a small governor (driven by a small band connection with the engine shaft) controlling the weight. This governor is adjusted to drop the weight, to open the relief valve and cause the throttle valve to close, when the overspeed of the engine reaches the danger point determined upon, and once adjusted requires no further attention. The bearings of the governor run on fibre graphite and require no oiling.

To give control of the engine from a distance and guard against accident to operatives and machinery in mills and factories, the different floors or rooms are protected by electric push buttons connected with an electric device operating through an electro magnet in the controller. A pressing of any of these buttons operates the controller, causing the engine to stop, the same as in the automatic action. These push buttons are of peculiar design, enclosed in small iron boxes and so arranged that they cannot be reached without ringing a small alarm bell, which prevents tampering by the inquisitive. This alarm bell also furnishes a means of testing the circuit without closing the valve.

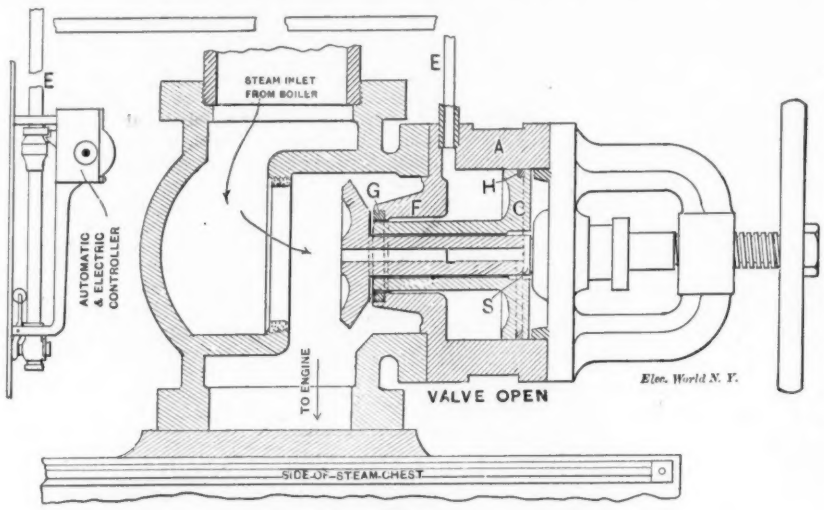


FIG. 1.

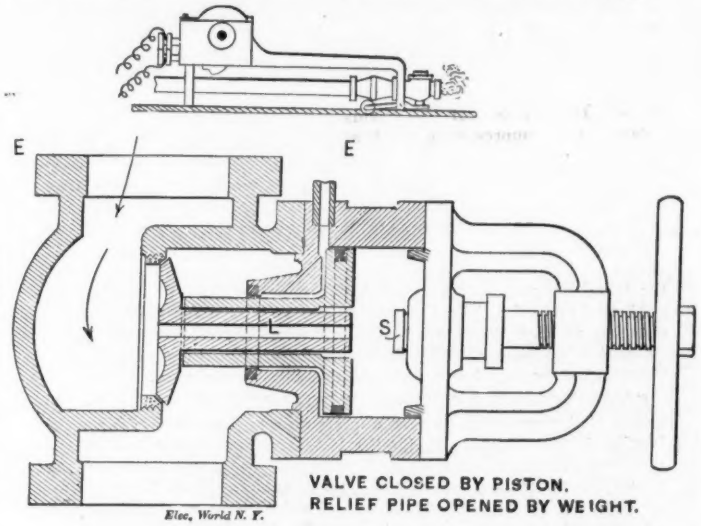


FIG. 3.

When used as a boiler valve in stationary or marine practice, the small relief pipe runs the length of the steam main and enters it at or near the throttle valve. Should the main steam pipe burst, the fall of pressure in the relief pipe would cause the valve or valves with which it is connected to close. It is also operated electrically and manually from a distance.

The Electro-Steam Appliance Company, 320 Broadway, New York, controls the manufacture and sale of this apparatus and owns the patents covering the same.

Exports of Scientific Apparatus.

During the year 1897 the value of instruments and apparatus for scientific purposes, exported from the United States, was $3,054,453, which was an increase of half a million dollars, as compared with the exports in 1896. Most of these exports consisted of electrical machinery. It appears from the statistics that England is the best customer. Scientific apparatus goes from this country to the United Kingdom, Mexico, Brazil, Germany, Canada, France, Argentina, Japan, British Africa, Brazil and Cuba. The exports of electrical material to the River Plate from this country, it is stated, increased considerably during the past year.

News of the Week

Financial Intelligence.

THE NEW YORK AND STATEN ISLAND ELECTRIC COMPANY has filed with the Secretary of State a certificate of increase of capital from $500,000 to $1,500,000.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Jan. 3, 1898.

DISSOLUTION OF PARTNERSHIP.—Notice has been given of the expiration by limitation of the copartnership heretofore existing between Messrs. Albert B. Herrick and James Burke, who composed the firm of Herrick & Burke. Both gentlemen individually will continue to devote themselves to the practice of electrical engineering at the old address, 150 Nassau Street.

IT IS REPORTED that one of the results of the recent conferences between officials of the Metropolitan Street Railway Company and the Third Avenue Railway Company will be the substitution of the underground trolley for the cable system now used on various lines in the city. The roads at present operated by cable are those on Broadway, Columbus Avenue, Third Avenue, 125th Street and Amsterdam Avenue above 125th Street.

THE DRY DOCK, EAST BROADWAY & BATTERY RAILROAD COMPANY has been granted permission to operate, in an experimental way, four of its cars by means of storage batteries. The experiments are to be conducted on that portion of the road lying between the terminus at the foot of Grand Street, East River, and the Desbrosses Street Ferry, North River. The permission will continue for a period of six months, from January 1, 1898.

THE MEMBERS OF THE ELECTRICAL WORKERS' UNION received an increase in wages of 50 cents a day after January 1. This increase brings their pay up to $3.50 a day for eight hours' work. The union has 1400 members, and they originally made a demand upon the Electrical Contractors' Association for $4 a day, which demand was refused. Each side then appointed a conference committee to try to avert a threatened strike and lockout by arbitration. A compromise, as above noted, was the result.

NEW TELEGRAPH FACILITIES IN MEXICO.—A dispatch from City of Mexico on December 28 states that the Mexican Telegraph & Cable Company and the Western Union Telegraph Company have secured a concession from the Government to connect their wires in the United States with the Federal lines at Nogales, Juarez, and Laredo. Through dispatches can thus be sent by Government wires to the United States and all points abroad. The Western Union, it is stated, will pay 15 per cent. of its receipts to the Government for the franchise, and guarantees that this payment shall not be less than $20,000 gold semi-annually. The Cable Company also pays the same percentage, guaranteeing at least $10,000 gold semi-annually. The Government agrees to send all its foreign dispatches by these two lines. The Central & South American Telegraph Company has no part in the new arrangement.

COMBINATION OF SURFACE ROADS IN BROOKLYN.—The financial status of the numerous surface electric railway lines in the Borough of Brooklyn has been very complex for the last few years, owing to the leases, rentals and purchases of franchises and systems by other roads, and the complex ownership and control of outstanding securities. Plans for the complete reorganization of the roads comprising what is known as the Nassau Street Railway system are now being considered by the several officers interested. It is planned to form a syndicate which will assume control of the various lines, taking up the outstanding securities and issuing for them stocks and bonds at a lower rate of interest. The object of the change is to reduce the rate of fixed charges and eliminate the fixed dividend on stock of the leased lines. The chief of these lines is the Atlantic Avenue Railroad, which is owned by the Kings County Traction Company, and by it leased to the Nassau system, for which a yearly rental of $180,000 is paid.

THE RAPID TRANSIT PROBLEM.—On December 31 last a set of plans and specifications for the construction of the Underground Rapid Transit Railroad were delivered to the engineers representing the principal capitalists of the Metropolitan Street Railway. The engineers are now going over the plans to make complete estimates. It is stated that several of the principal stockholders of the Metropolitan Street Railway Company, including Hon. W. C. Whitney, H. H. Vreeland, John D. Crimmins and others, will make a strong effort to secure the contract to build and operate the rapid transit road. There are now four syndicates or associations ready to bid on the plans. The Appellate Court will not be asked for an order to carry out its recent decision until full opportunity is given to all prospective bidders to examine fully into the plans and ascertain what they can do with reference to the bond of $15,000,000 imposed by the court. The court will decide whether the bond is to apply to the period of construction only or during a period of fifty years.

A PRACTICAL TEST was made in the office of the New York *Herald* on the night of January 1 of a method of transmitting pictures electrically over a wire. The instrument is the invention of Mr. Ernest A. Hummel, of St. Paul, Minn. It is stated that the test, which was conducted under strict supervision, was satisfactory in every respect. The portrait of Mayor Van Wyck was transmitted over a circuit 6 miles in length. The picture to be transmitted is drawn with an insulating ink. In the operation of transmission a platinum point passes to and fro over the picture and opens the circuit each time it passes over the ink marks, the circuit remaining open a length of time corresponding to the length of the mark over which the point passes. The receiver is practically a duplicate of the transmitter except that a stylus at the end of the traveling arm, operated by an electromagnet, marks a black line on the paper. Both the transmitter and receiver work in synchronism, and the black lines are produced at the receiving end by the pressure of the stylus on carbon paper.

THE BRIDGE TROLLEY INJUNCTIONS REMOVED.—On December 31 Justice Van Wyck, in the Supreme Court, Brooklyn, denied the application of T. S. Stillman to restrain the Bridge trustees from laying tracks on the Bridge structure. The Appellate Division of the Supreme Court on the same day reversed the order of Justice Andrews, granted in November, restraining the Bridge trustees from permitting the building of the proposed loops across the promenade at the New York station. As soon as the injunctions were dissolved a gang of men were put to work, stringing the trolley wire on the north roadway, with the object of running the first car over the Bridge before the year closed. At 11:30 P. M., everything being in readiness, the private car "Montauk," containing Mayor Wurster, of Brooklyn; Mr. Tom L. Johnson and his brother, "Al" Johnson, and several other officials of the railway company, was run across the bridge and back. The actual work of completing the improvements cannot, however, be undertaken until the order of the court has been entered. It is stated that it will take about three months' time to finish the work at the New York end. The rails have been laid on the north roadway from Brooklyn to the east end of the New York terminal station, but on the south side there is a little more work yet to be done. The necessary changes at the New York station to permit the laying of the four loops will take a good deal of time. The New York *Journal*, which secured the original loop injunction, announced that it would to-day file a notice of appeal.

THE ANNUAL REPORT of the Brooklyn Bridge trustees shows the receipts from the railway service during the past year to have been $1,150,064, the number of passengers carried being 45,542,627. During the year the trustees considered the adoption of a block signal system on the railway, without reaching, however, any convincing results as to its efficiency or reliability. The report states the reason why the electric system does not entirely displace the cable in the propulsion of trains across the bridge. In a round trip over the railway, that is, from one station to the other and back again, a train in surmounting the grades over the structure has to be lifted about 140 feet; thus, if all the trains in service are attached to a running cable, it involves an expenditure of power but little exceeding that required to haul the same number of trains over a level track, the trains descending nearly or quite balancing those ascending. If electric motors were used for hauling the trains over the main lines, whatever power was expended in surmounting the grades could not in descending be returned or compensated for; as a result there would be a loss of power equivalent to that required in a round trip to lift each train vertically to the extreme height mentioned. Trains running attached to the cable are separated by fixed and uniform spaces as determined by the wisdom of the superintendent in charge; while if trains were hauled by independent motors this spacing would be subject to individual care and judgment. In the first case, collision between the trains running close to each other, as they must during the busy hours, is effectively guarded against; on the other hand, if the movement of each train was controlled solely by its motormen, collision between trains might be frequent.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Jan. 1, 1898.

THE BOSTON STREET RAILWAY COMPANY on December 31, 1897, succeeded the West End Street Railway Company, the elevated people coming into actual as well as financial control. Gen. W. A. Bancroft, vice-president and general manager, assumed the active management of this combined transportation system. General Bancroft was for eight years connected with the West End system and is consequently thoroughly familiar with it. There are a great many rumors with regard to the retention of old West End officials, but it will be several days before anything definite is known.

A PUBLIC RECEPTION was given by the Manchester (N. H.) Electric Light Company on the afternoon of December 22 to afford the citizens an opportunity to inspect the company's plant, which has recently been enlarged. A large number of prominent persons were present, and all were delighted with what they saw and the reception. The plant includes three railway generators, three three-phase alternators, two with a capacity of 5000 16-cp lights and one of 2000 lights; two 500-volt generators for power work and fourteen arc dynamos, ranging in capacity from fifty to 125 lights. The switchboards for the lighting and railway services are very complete.

THE ANCHOR ELECTRIC COMPANY, Boston, is now under new executive management, with the exception that the former vice-president, Mr. Norman Marshall, is hereafter to be the new treasurer. Mr. H. C. Hawks and Mr. Phillip M. Reynolds have sold their interests to Mr. Marshall, Mr. George O. Proctor, and Mr. Guy H. Proctor, of Somerville, and Mr. Frank Ridlon, of

Boston, who comprise the new executive and directorate. Messrs. Hawks and Reynolds will no longer be connected with the company. Mr. George O. Proctor will be president. Mr. Proctor is well known in business circles, and has been prominently connected with the Massachusetts Legislature. Mr. Guy H. Proctor, his son, has been conspicuously connected as salesman with the rubber business in Boston. Mr. Marshall and Mr. Ridlon need no introduction.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., Jan. 1, 1898.

PARTRICK, CARTER & WILKINS is the firm name adopted on January 1 by Messrs. Franklin S. Carter, Charles M. Wilkins and E. Ward Wilkins, who have heretofore traded in this city under the name and style of Partrick & Carter Co. The headquarters of the firm are at the old stand, 125 South Second Street. The firm is sending to its customers a neat pocket memorandum book, with the compliments of the season.

DISSOLUTION OF PARTNERSHIP.—Mr. Hiram C. Roberts has retired from partnership in the firm of Vallee Brothers & Co., 625 Arch Street, this city. Messrs. Garrett A. Vallee and George W. Vallee, having purchased Mr. Roberts' interest, will continue the business at the old address under the old firm name. The change took place on January 1, and was by mutual consent.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., Jan. 1, 1898.

THE FIRST IRON for the new suspension bridge that is to take the place of the first one below Niagara Falls has arrived. It is promised that the new bridge shall be ready for traffic by April, and the present one shall be placed across the river at Lewiston at the lower end of the Gorge Railroad. A plan is on foot to form a belt line of existing trolley roads, to run over these two bridges, but so far the refusal of the Niagara Reservation Commissioners to allow tracks to be laid on any reservation land cuts off the approach to the new bridge on the American shore. It is quite likely this objection will be overcome in good time, however.

MR. HORATIO A. FOSTER made an address during the week before the Buffalo Real Estate Exchange on the subject of "Niagara Power." He said in the course of his remarks that "in every case but one, not only were the results financially in favor of the Niagara power, but so far in its favor that it would be difficult to understand why any man should hesitate to take it up when he learns for what price it can be had for use in his own business. There may be a few special cases, like the single exception above noted, in which the application of Niagara power would be of little advantage, but they would be few and far between and would cut no figure in the general results."

SECRETARY RANKINE, of the Niagara Power Company, has been trying to quiet the Canadian "uprising" against his company. He gave an address in the town hall at Niagara Falls, Ont., in which he was somewhat severe on the people who had been stirring up opposition to the power company, and appears to have been quite successful in convincing the community that the company was prepared to meet the demand for power on that side of the Falls. He was followed, however, at another meeting, by A. C. Dennison, of Philadelphia, who did what he could to discredit Mr. Rankine's remarks, and urged the people to go ahead and set up a company of their own, as had been planned. Mr. R. P. Slater, who is at the head of a company that proposes to utilize Chippewa River by turning it backward and finding a sufficient fall near the Welland Canal, also made some remarks. He made the statement that the Niagara Power Company was using immense amounts of money in its operations, and had asked for an additional $2,000,000 after $3,000,000 had been expended. So far nothing decisive has been done.

PITTSBURG NOTES.

PITTSBURG, Pa., Jan. 1, 1898.

A CHARTER WAS ISSUED by the State Department, at Harrisburg, on December 28, 1897, to the Kittanning & Ford City Street Railway Company, of Armstrong County, for a road 7 miles long, to run from Nealton to Kittanning. The capital stock is $50,000. Frank H. Moesta, of Kittanning, is president.

WIRE ORDINANCE PASSED.—The ordinance, previously described in THE ELECTRICAL WORLD, giving the Department of Public Works supervision over all overhead and underground wires installed along or across the public streets and alleys, and requiring a permit to be taken out and plans submitted before such wires can be installed, was passed by Select Council this week. It was approved by Common Council some weeks ago. This measure affects chiefly the owners of isolated plants, whose wires heretofore have been placed in the streets at will, without permit or inspection, and without any control from the municipal authorities.

WESTINGHOUSE APPARATUS GOING TO MEXICO.—The Westinghouse Electric and Manufacturing Company, it is announced, has recently closed a contract with the Compania de las Fabricas de Papel de San Rafael y Anexas, for a complete electric power plant, having a capacity of 1500 horsepower. This company has a twenty-year concession from the Mexican Goverment, giving it the exclusive right to manufacture certain of its products. Its present wood-grinding machinery is driven by electric motors, with such satisfactory results that its large equipment of new paper-making machinery, which has just been purchased in this country, will all be driven in the same way. The generators will be driven by water power, developed several miles from the company's plant, and the power will be transmitted electrically.

UNITED TRACTION COMPANY PREFERRED STOCK FOR SALE.—Alexander Brown & Sons, of Baltimore, Md., and N. Holmes & Sons, of this city, offer for sale 60,000 shares of the United Traction Company's 5 per cent. cumulative preferred stock, par value $50 per share, for $40 per share, ex January dividend of 2½ per cent. Subscriptions will be opened on Wednesday, January 5, 1898, and closed at 3 P. M. the following day. Application will be made to have the stock listed on the Philadelphia, Baltimore and Pittsburg Stock Exchanges. This is the entire issue of preferred stock in this company, and in addition to the 5 per cent. cumulative dividends, it is entitled to share equally with the common stock in the surplus profits in each and every year after the common stock shall have received dividends at the rate of 6 per cent. for each year.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Jan. 1, 1898.

THE AMERICAN RHEOSTAT COMPANY, of Milwaukee, Wis., has opened a Chicago office at 1104 The Rookery, and appointed as its agent the George Cutter Company, who will carry a complete line of rheostats for all purposes.

MR. EDWARD B. ELLICOTT, City Electrician, will lecture on Fire Alarm Systems before the Engineers' Club, of Chicago, on the evening of January 7. On Friday, January 8, the club and its friends will visit the power plant of the City Railway Company, at Forty-ninth Street and Oakley Avenue.

MR. GEORGE W. PATTERSON has recently been appointed Western representative of the American Circular Loom Company, Chelsea, Mass. He is known to the electrical trade through his connections, as Western agent, with the Gordon-Burnham Battery Company, of New York; the Fibrite Company, and other concerns. His office is at 1114 Marquette Building.

MESSRS. FOSTER & LEWIS, contractors, Fisher Building, Chicago, have sold their contract for the building of the Holland, Mich., electric railway and lighting plant to Messrs. H. B. Black, I. E. Cockran, Jr., and Mr. Powell, all Chester, Pa., capitalists. At a recent meeting in Chicago of the Holland and Lake Michigan Railway Company, Messrs. Humphreys, Larsons, Ferguson were succeeded by the election of new officers, as follows: Mr. H. B. Black, president; Mr. Powell, treasurer; I. E. Cockran, Jr., secretary, at which time the stock and bonds were also turned over to the new organization. The City of Holland has extended the franchise, which expired January 1, 1898, to June 18, 1898. This road when completed will be 7 miles in length, and will run between Holland, at the head of Black Lake, and Ottawa Beach and Mackatawa Park, well-known Michigan summer resorts. The grading, bridges and power house are all completed. It will take some four or five weeks to complete the road and have it ready for operation.

THE CHICAGO ELECTRIC TRACTION COMPANY was incorporated on December 31, 1897, with a capital of $2,000,000. The company, it is stated, will give this city another large street railway system. It has already acquired by purchase twelve franchises in the southern part of the city. Under three or four of these grants 32 miles of tracks have been built and are now being operated by the Calumet Electric Railway. Before summer the new corporation expects to have in operation 100 miles of tracks, extending from Sixty-third Street, between State and Stony Island Avenues, south, with extensions to the Indiana State line. The company will at once issue $1,500,000 of first mortgage bonds. The capital, it is stated, is supplied by bankers and business men in New York and Philadelphia. Further issues of bonds will be made from time to time as the corporation's enterprises develop. The Eastern capitalists backing the company are Samuel R. Shipley and Henry Lewis, of Philadelphia; Isaac L. Rice, Gustave J. Wetzlar, and Jules S. Bache, of New York City. The Calumet Electric Railroad is the leading asset of the new concern. This road either controlled or owned most of the franchises acquired by the new corporation.

TEXAS NOTES.

SAN ANTONIO, Texas, Dec. 28, 1897.

THE BIG BUCHEL DAM, located near Cuero, Tex., is about completed. Buchel Brothers, the builders of the dam, have just signed a contract with the Western Electrical Supply Company, of St. Louis, for an electric light plant on the Stanley system, with a capacity of 4000 lights, to be put in at once, the dam to supply the water power. The plant will be shipped at once, and it is expected that within sixty days good headway will have been made in the work.

AFTER A LONG PERIOD OF LITIGATION the case of Eugene Early *vs.* the Waco Electric Railway & Light Company has come to an end. The litigation began four years ago by the appointment of a receiver for the plants of the corporation named. The Metropolitan Trust Company intervened, setting up a mortgage given to secure bonds issued for the sum of $200,000, and the General Electric Company, of New York, set up a chattel mortgage on the machinery of $36,000. There were many small interventions, all of which were settled. The Waco Company having purchased the entire bond issue, the claim of the General Electric Company and smaller liabilities, Judge Jennings entered a decree confirming title to the entire property in the Waco Gas Company and the Citizens' Street Railway Company, which corporations are now the owners in fee simple of both the street railway company and the electric light plant, worth $500,000.

MEXICAN NOTES.

MONTEREY, Mexico, Dec. 28, 1897.

THE WORK OF INSTALLING THE NEW MACHINERY in the electric light plant at San Luis Potosi, in the State of that name, is progressing rapidly. The work is in charge of Mr. Thomas Muller, who has resided in Mexico many years.

THE POWER FOR THE GENERATION of the electric current used in lighting the city of Guadalajara is furnished by the falls of Juanacatlan, located

fifteen miles from the City of Guadalaiara. The city is second in size in Mexico. There is a great amount of wealth centred there.

MR. MILTON THOMPSON, of the electric light plant at Hermosillo, State of Sonora, has secured a concession from the Government for the establishment of an electric light plant at Guaymas, in the same State. It is estimated that the cost of the proposed plant will be $30,000, gold. Mr. Thompson represents the Compania Explotadora de Maderas, which will own, control and manage the plant.

IT IS LEARNED on reliable authority that a contract has just been entered into between the Western Union Telegraph Company, the Mexican Government and the Federal Telegraph Company, of Mexico, by the terms of which the Western Union is given an absolute monopoly of the international telegraph business of this country. The contract is one of the most far reaching of its kind ever entered into and will, it is said, drive the Postal Telegraph Company out of business in this country. It is stipulated in the contract that all international telegraph business must be done over the lines of the Federal Company, which have been leased for a long term of years by the Western Union Company. The Postal Company only recently entered the Mexican field and has long term leases on the wires of the Mexican National and Mexican Central Railways, connecting with its own wires at El Paso and Laredo, Tex. Since the opening of its offices in Mexico it has been doing the bulk of the international commercial telegraph business, and it was this fact which aroused the Western Union to action and caused it to make the contract which gives it a monopoly of the Mexican business. The Postal will take the matter into the courts and will make a strong legal fight against the prohibitory clause in the contract of its competitor.

Pacific Coast Notes.

San Francisco, Cal., Dec. 27, 1897.

THE COMMERCIAL LIGHT & POWER COMPANY is extending its two-phase electric power system in San Francisco. Mains are being laid on Commercial, Sansome and California Streets. Considerable additions to the generating plant are contemplated.

MR. A. C. SANDS, superintendent of the Northwestern division of the Sunset Telephone & Telegraph Company, will report favorably on the proposed construction of a telephone line over the Chilcoot Pass, from Sheep Camp to Lake Bennett, and possibly, also, for a line over the White Pass, from Skaguay, Alaska, to Lake Bennett.

THE LOS ANGELES EDISON ELECTRIC COMPANY has been incorporated, with Los Angeles, Cal., as the principal place of business. Capital stock, $500,000. Directors, Thomas Addison, F. M. Pickering and J. E. Green. This company is expected to handle the interests acquired some months ago by the West Side Lighting Company.

THE REALTY SYNDICATE'S STREET RAILWAY LINES in Oakland, Cal., are now managed by Ira Bishop, and Mr. Gates, who recently arrived from the East, is chief electrician. Messrs. Rudolph, Gibson and Fisher have retired from the management. The new order requiring conductors and motormen to carry the insurance on the cars, through the system of the Pacific Surety Company, recently went into effect, and the men failed to protest publicly, though many of them strongly opposed the plan. The syndicate intend to abandon several franchises on streets where the consolidation of a number of roads has given them parallel lines.

MR. W. A. BURKHOLDER, who recently resigned his position as general superintendent of the Portland General Electric Company, has just left this city for Alaska, under an engagement with the Westinghouse Electric Manufacturing Company. That will include the electrical engineering work for the aerial tramway plant, which will be installed for the Dyea-Klondike Transportation Company. There will be a 45-kw alternating current transmission plant, with generator driven by water power. The wire rope carrier system will be operated by an electric motor. The Washburn & Moen Manufacturing Company has taken the contract for the wire, etc. The tramway is to extend over one of the passes near Dyea, and it is expected to greatly facilitate the transferring of freight, etc.

THE SUNSET TELEPHONE COMPANY'S business, and that of its allied lines, had a phenomenal increase during 1897. There are now over 11,000 telephones connected with the system in San Francisco, and 27,000 in the State of California. The long-distance lines in California furnish connection with about 751 towns, between Redding and San Diego, and consist of 13,409 miles of copper wire. The completion next summer of the connection between the California system and that of Oregon will enable communication to be had from San Diego, Cal., to Spokane, Wash., the distance being 2200 miles, and the new extensions into Idaho will increase that distance by 500 miles. With the weight of wire used at present, commercial business would not be transacted, but heavier wire will be strung later for a part of the distance, to enable conversations to be carried on successfully.

Canadian Notes.

Ottawa, Ont., Jan. 1, 1898.

THE WALLACEBURG ELECTRIC LIGHT COMPANY, of Wallaceburg, Ont., contemplates putting in an incandescent plant in that town, having contracted to do so within eight months.

THE BY-LAW to guarantee the sum of $50,000 for the building of an electric railway at St. Thomas, Ont., was carried by the rate payers of that town by a large majority. Under agreement, the company is bound to build 6½ miles of track.

DURING THE FISCAL YEAR OF 1896-7, the receipts for electric light inspection, in the Dominion of Canada, amounted to $6,895, and the expenditure to $9,021, of which only $1,830 was for salaries. The Ottawa Electric Company is registered as maintaining 62,740 lamps in the city.

A COMPANY IN DETROIT, MICH., has made a proposition to build an electric railway from the town of Amherstburg, Ont., to Windsor and Harrow, and in connection with which it demands a bonus of $15,000. Estimates for grading, bridges, culverts, etc., have been made. Several bridges will be required if the road is to be proceeded with.

A COMPANY HAS BEEN FORMED at St. Catharines, Ont., and plans have been matured for the purpose of building an electric railway between St. Catharines and Port Dalhousie. It is expected that the road will be completed and in operation some time during May next. Mr. H. D. Symmes, manager of the St. Catharines and Thorold road, is chief promoter of this enterprise.

THE ELECTRIC LIGHT COMPANY, of Dartmouth, N. S., has offered to dispose of its plant to the town for $30,000. By agreement the company was bound to give the first right of purchase to the corporation. The Citizens' Committee has replied that the plant is not suited to the requirements of the town; and it is probable that arrangements will be completed with a New York company, represented by Mr. C. K. Corsant, to purchase the plant. This company, it is said, has in view the development of the water power at Fall River, at an expenditure of $100,000.

IN RESPECT TO THE PROPOSED TRANSMISSION PLANT at Goldstream, B. C., Mr. F. S. Barnard, manager of the British Columbia Electric Railway Company, writes: "We have not yet definitely decided upon plans for a transmission plant. I may say, however, that our generating station will have a capacity of about 1000 horse-power, developed by water delivered under a 570 foot effective head. This power will be transmitted at a voltage of about 10,000 to the sub-station at the city of Victoria, B. C., a distance of about 12 miles, and there distributed for the purpose of street-car locomotion, arc and incandescent light and power circuits."

ANOTHER BIG ELECTRIC DEAL has just been put through at a cost of about $150,000. After considerable dickering the property, rights and franchises of the Temple Electric Company, of Montreal, are about to be acquired by the Standard Light and Power Company, of that city. The deal was practically arranged over a month ago, but the directors of the Temple Company only recently met and made a formal ratification of the sale, which makes the Standard Company one of the most important electrical concerns in Canada. Another feature of the deal is that while the Lachine Rapids and Land Company does not supply the direct power to run individual motors, say for private lighting, elevators, etc., it will in future furnish the power to the Standard, under a contract just made, and which implies the turning over of many thousands of dollars. The Lachine Company has also brought to a successful consummation its efforts to supply power to the Imperial Electric Company, of Montreal, for a term of five years.

French Notes.

(From Our Own Correspondent.)

Paris, France, Dec. 24, 1897.

THE EXPOSITION OF 1900.—The hard times which we have had for some time past have closed up a great many workshops. This has not been true, however, of the builders of the Palace on the Champs de Mars, which is rapidly going up. By next month the old Palace of Liberal Arts will have completely disappeared. Meanwhile the administration is busy transplanting all the trees which are now standing upon the grounds where the various buildings will be erected. The greater part of the trees are being taken to the Bois de Bologne, while others are being replanted in situations chosen for gardens around the new Exposition grounds. M. Alfred Picard, general commissioner, has been given considerable trouble by requests for admission to the grounds. Concerning the right to take photographs in the Exposition enclosure, this will probably be made the subject of a concession.

THE NEW MAGNETIC LABORATORY OF THE PARC ST. MAUR OBERVATORY.—The meteorological observatory at Parc St. Maur, near Paris, has just enlarged its buildings for the reception of a special laboratory arranged for magnetic observations. The inauguration of the buildings took place a few days ago. In order to bring into accord, as far as possible, the old observations with those of the new series the new magnetic registering instruments have been kept at work for some time past. The instruments of the new building are identical with those which have been used since the establishment of the observatory, and consist of Mascart magnetometers. The principal innovations consists of the methods devised by M. Moureaux, director of the observatory, to eliminate the perturbing forces which have disturbed the indications of the instruments, of which the sensitiveness is very great. M. Moureaux was able to show some registration of the recent earthquake felt in Greece and at Constantinople. The time of this disturbance was registered at Paris in a fashion perhaps more exact than it was at any place in the disturbed countries. The new laboratory consists of an isolated pavilion surrounded by a high fence which does not allow anyone to approach within about 20 yards of the building. The great vault is 2 x 6 metres in size. Leading into this is an outer chamber and cabinet where the seismograph is installed. Here is also placed an astronomical clock, in the construction of which no iron whatever was used. This clock sends out periodically, into the registering room, currents which act upon the position of the magnetized bars and thus make reference points, the position of which permits the determination, with great precision, of the times of perturbations which are registered. Thanks to this arrangement the other clock which is mounted in the subterranean room is only used to reel off the sensitized paper upon which the registrations are made. All the materials employed throughout have been carefully tested by M. Moureaux for iron, and their employment has not been authorized until it was certain that their influence upon the magnetized needle was entirely negligible. On this account the use of red bricks or red paving tiles has been prohibited and only white lime mortar, slate, limestone and gray paving tiles coming from Pont St. Maxime were allowed in the construction. Finally, a very elaborate determination was made of the magnetic elements outside of the building and inside in order to be certain that the same values were obtained in each case. For several months past the underground rooms have been vigorously heated and at the same time thoroughly ventilated in order to assure the total disappearance of any trace of humidity. The instruments are placed

under bell glasses enclosing sticks of caustic potash to absorb any moisture that may make its appearance. In one of the underground rooms, which is used for the direct-reading instruments, are three piers carrying the declinometer, the inclinometer and the bifilar magnetometer. On the central pier are arranged three reading telescopes, one for each of the instruments. In the other vault the central pier carries the lamp and the sensitized paper for the registering instrument, and in both of the halls are automatic registering thermometers and hygrometers of very sensitive construction. The humidity record so far is almost zero, while the temperature is so constant that diurnal oscillations appear to be entirely suppressed. The annual oscillations are apparently in the neighborhood of 10 degrees and so slow that the correction formulæ can be applied to them with great precision. The air temperature varies so slowly and in such a definite way that it is perfectly safe to take it as that of the magnets. The observer who has to read the direct-reading instruments will never be able to deceive the director about the hour of his visits to the vault or their number, for a little wave indicates upon both the hygrometer and the thermometer that he has brought with him a change of temperature and humidity from the outside. These small and short temperature changes, however, are not felt by the magnets and have little or no effect upon the bifilar instrument.

General News.

THE TELEGRAPH AND TELEPHONE.

FENTON, MICH.—The Bell Telephone Company has reduced its rate to Detroit from 40 cents to 10 cents.

LOUISVILLE, KY.—The Ohio Valley Telephone Company has purchased the telephone line between Elizabethtown and Hodgenville.

DAVENPORT, IA.—The Iowa Telephone Company last year built 1460 miles of metallic circuit, copper wire being used very largely.

WHITE EARTH, MINN.—A project is on foot here to establish a telephone line to connect the White Earth Agency with Detroit City, a distance of some 22 miles.

INDIANOLA, IA.—A new telephone exchange is to be established here and controlled and operated by citizens of the place. A new company has been organized for the purpose.

CHARLOTTE, MICH.—The Michigan State Telephone Company will establish an exchange in this place. The Bell Telephone Company, who occupies the field, has reduced its rates.

FARMINGTON, MO.—The City Council has granted a franchise to Kossuth W. Weber and T. P. Pigg, of this place, to establish a telephone system here. Work will be commenced at once.

SIDNEY, OHIO.—A new telephone line is being built between Botkins and Fort Wayne, Ind., by way of New Knoxville and St. Mary. Another line is being built from Botkins to Geyer, and thence to Santa Fé and Lake View, this State.

NEWBURGH, N. Y.—The Hudson River Telephone Company has arranged for a considerable extension of its lines through Pike, Monroe and Wayne Counties, Pa.; Sussex County, N. J, and Orange, Sullivan and Ulster Counties, N. Y.

LOUISVILLE, KY.—The telephone war at Owensboro, between the Cumberland Valley and Home Companies, is a good thing for the users of telephones. The Cumberland Company's last cut in prices was from $1 to 50 cents a month for residences.

TORONTO, OHIO.—A contract has been closed whereby the Wellsburg Telephone Company and the Phœnix Company will interconnect their exchanges. This arrangement will place several towns in this part of the State in communication with one another.

FREMONT, OHIO.—A new telephone exchange is to be established here by the Clyde Independent Telephone Toll Line Company. Fremont and Clyde will then be connected with each other by the new system. The company is also running lines to Green Springs, Vickery, Bellevue and other points. Oak Harbor and Tiffin will also be connected. This is the first step toward one large system of independent telephone exchanges which will give service to this part of the State.

IONIA, MICH.—The new State Telephone Company has been granted a franchise to establish an exchange in this place, and has commenced work in erecting poles. In consequence of the opposition the Bell Company has cut its rate to $24 for business houses, and $12 for residences. The former prices for these services were $36 and $24, respectively. The new State Company, it is stated, will charge $24 and $18. The Bell Company has also cut its State tolls to 10 cents within the county, 15 cents within a radius of 30 miles and 20 cents for 50 miles.

ELECTRIC LIGHT AND POWER.

SEAFORD, DEL.—The erection of an electric light plant at this place is contemplated.

BROWNSTOWN, IND.—The Council has the question of municipal lighting under consideration.

SHELBINA, MO.—It is almost certain that the Shelbina electric light plant will be enlarged in the spring.

SOMERVILLE, MASS.—The city is agitating the question of establishing a municipal electric light plant.

IRONTON, OHIO.—The scheme to bond the city to build and operate an electric plant has been defeated.

WILLIAMSPORT, PA.—The city is agitating the question of erecting a municipal electric lighting plant.

GREENWOOD, S. C.—The $40,000 worth of bonds for erecting water works and an electric lighting plant have been disposed of.

CLINTON, IA.—There is some talk of putting in an electric light plant to supply incandescent lights for the business houses and dwellings.

LANCASTER, WIS.—The City Council has decided to grant an electric light franchise, and work on the plant will begin in the near future.

FERNANDINA, FLA.—At meeting of City Council, the special committee on electric light was authorized to advertise for bids for the erection of a power house.

SCRANTON, PA.—At meeting of Common Council ordinance providing for the issue of $200,000 to establish a municipal electric light plant passed third reading. The proposition will be submitted to the voters at the spring election.

HOMER, ILL.—At a special meeting of the City Council, called for the purpose of considering the question of electric lights, it was decided to call an election to vote on the question of bonds for an electric light plant.

CENTREVILLE, IA.—The Centreville Electric Company, a new corporation, has agreed to build a new plant if it is given a twenty-five-year franchise to furnish the city fifty street arc lights, of 2000 candle-power each, at $3000 a year.

WASHINGTON, D. C.—The *Evening Star* Company contemplates the erection of a model office building, in this city, to cost $300,000, where possible electricity will be employed as the motive power, and the building will have its own motors and dynamos.

OWOSSO, MICH.—The City Council of Corunna has granted an electric light franchise to Clarence Hawley, of Detroit, for twenty-five years, and closed a ten-year contract with him for thirty-five lights at $42.50 per light per year. Incandescent lights will be supplied to private consumers at 25 cents a month per lamp.

WEST BAY CITY, MICH.—A new electric light plant has been established in this place, and is run in connection with the water works. The plant will be used for city and commercial lighting. It has an arc-light machine of 160 lights, a 75-kw incandescent Westinghouse generator and two Gates engines of 125 horse-power each. The plant cost $20,000. Mr. George Cornish is superintendent and Mr. George L. Lusk secretary.

LARAMIE, WYO.—The Laramie Electric, Gaslight and Fuel Company is in the market for two 12 x 12 self-oiling engines, to be directly connected to two 50-kw generators. The company's municipal system is to be re-wired for 15 arc lamps and 100 incandescents, all to be lighted from the incandescent circuit. The domestic system will be taken care of by the new generators. The company operates on the Edison system.

THE ELECTRIC RAILWAY.

MARCUS HOOK, PA.—The Council has granted a franchise to the Chester Traction Company for a trolley line from here to Wilmington.

MIDDLETOWN, MASS.—The Town Council has granted a franchise to the Portsmouth Railroad Company to operate its lines through the city.

BARRE, MASS.—The Barre Street Railway Company is surveying for a trolley line to connect the Boston & Maine Railroad with Barre Centre.

WALTHAM, MASS.—The Lexington Railway Company and the Newton Railway Company have petitioned the Board of Aldermen for a franchise.

GREENSBURG, PA.—South Greensburg Council has granted to the Greensburg and Mt. Pleasant Street Railway Company the right of way through that borough.

CONNERSVILLE, IND.—The Connersville Street Railway Company was granted a fifty-year franchise by the City Council. The company is composed of Charles Mount, G. C. Floron, E. W. Ahmsted, Thomas Downs, etc.

RAVENNA, OHIO.—The Osborn-Kimball Engineering Company, of Cleveland, have asked the County Commissioners for a street railway franchise through Portage County to connect with the Akron, Bedford and Cleveland line.

LEGAL NOTE.

THE MURRAY IRON WORKS COMPANY, Burlington, Ia., has begun suit against the R. G. Dun Mercantile Agency for $20,000 damages, growing out of the circulation of a report regarding the company, which the Murray Iron Works Company claims to be misleading and injurious to its credit. The facts in the case, as reported to us by the Murray Iron Works Company, are substantially these: For the purpose of making certain additions and improvements to its plant it recently decided to issue a small number of bonds, and in order to secure the same executed a trust deed for $50,000. In reporting this transaction to their subscribers Messrs. R. G. Dun & Co., it is alleged, stated that the Murray Iron Works in executing the deed had preferred certain creditors, thus giving the impression that the concern had become embarrassed. The plaintiff avers that this is not so; that on the contrary, the company is practically free from debt and that it possesses abundant means to fulfill all of its engagements.

PERSONAL NOTES.

MR. S. G. McMEEN, engineer of the Central Union Telephone Company, Chicago, Ill., was married to Miss Auta Judith Proctor, of Ashtabula, Ohio, on December 23, 1897. Mr. McMeen's many friends will no doubt wish him and his bride a long and happy life.

PROF. ALEXANDER MELVILLE BELL, father of Prof. Alexander Graham Bell, was married on January 1 to Mrs. Harriet G. Shibley, of Harrowsmith, Ont. The wedding, which took place at the Park Avenue Hotel, New York, was private, only a few relatives and friends being present. Among these were Prof. A. G. Bell and his daughter, Elsie. The bridegroom is seventy-eight years of age and his wife twenty-five years younger.

Trade and Industrial Notes.

THE BRADFORD BELTING COMPANY, Cincinnati, Ohio, is issuing to its friends a monthly calendar for 1898.

THE LESCHEN-MACOMBER-WHYTE COMPANY, 19-21 South Canal Street, Chicago, is distributing a monthly calendar for 1898. It contains a very pretty marine view.

THE WARREN ELECTRIC & SPECIALTY COMPANY, Warren, Ohio, is sending out, with its compliments, an 1898 calendar. The pictorial subject is a handsome one, in colors.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., is distributing an 1898 calendar, on which is printed in colors a view of its extensive works at Phillipsdale, R. I.

"A COOL RETREAT" is the title of a handsome engraving on the calendar being sent out by Mr. William A. Rosenbaum, the patent attorney, Times Building, New York. The picture is a refreshing one, particularly at this season of the year.

MR. CHAS. D. SHAIN, of 136 Liberty Street, New York, does not drop into poetry in his New Year's greeting this year, but sends to his friends a postal card to convey "eighteen hundred and ninety-eight (1898) good wishes for you in the New Year."

THE HILLES & JONES COMPANY, Wilmington, Del., has just issued a catalogue of its machine tools. The illustrations are particularly handsome in execution, being remarkably clear and quite large. This company makes a complete line of machine tools.

MR. A. B. LAURENCE, 120 Liberty Street, New York, manager of the Shultz Belting Company, St. Louis, Mo., has sent us a copy of a very artistic calendar for 1898. It contains a handsomely colored portrait of a woman. The coloring is natural, and the print is well executed.

MR. JAMES L. GETHINS, formerly of the firm of Burnham-Gethins Company, writes to say that he is still located at the old address, No. 181 Tremont Street, Boston, Mass. He carries on the same line of business as that transacted by the partnership which has recently been dissolved.

A TELEPHONE CATALOGUE has just been issued by the Simplex Interior Telephone Company, 431 Main Street, Cincinnati, Ohio. The various styles of instruments made by the company are described and illustrated. The company makes an efficient emergency street railway telephone, in addition to its line of standard instruments.

HENRY R. WORTHINGTON is contemplating enlargements of present storage capacity for castings for the standard sizes of pumps made by this concern. It now carries in storage from two to three months' supply of all standard castings of 6-inch stroke pumps and smaller sizes. It is now proposed to extend this system to standard pumps of much larger sizes.

THE IRON CLAD RHEOSTAT COMPANY, Westfield, N. J., informs us that it has recently standarized an entirely new line of motor starters. Its rheostats are said to be giving universal satisfaction. An entire reorganization of the manufacturing, as well as the business department, gives the company exceptional facilities for the prompt shipment of orders, whether of a standard or special nature.

MESSRS. JAMES L. ROBERTSON & SONS, New York, have been awarded, by the judges of the Tennessee Centennial Exposition, at Nashville, three diplomas of merit for their exhibit, which consisted of Robertson-Thompson indicators, Lippincott planimeters, and Eureka packing. Engineers and steam users can learn all about these articles by sending to the firm for illustrated literature on the subjects.

THE WALKER COMPANY has just issued two circulars relating to marine generators and arc lamps. The former gives data of marine generating sets with Sturtevant engines. The Walker Company has developed a dynamo which it believes fulfills every requirement of marine service. The second catalogue describes and illustrates the Walker Company's arc lamp, which is said to embody every desirable feature of a modern lamp.

THE WHEELER REFLECTOR COMPANY, Boston, Mass., informs us that it received its proportionate share of prosperity during the past year, and is confident of realizing even better results during the year just begun. General business conditions, it says, are unquestionably improving, and if manufacturers and dealers have learned the lessons in prudence which the recent general depression should have taught them, they are in excellent position to share in the fruits of legitimate enterprise.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Chicago, is experiencing a very successful closing of the old year, and its new year is opening exceedingly encouraging. It has a large number of orders for re-equiping exchanges, besides the furnishing of many complete equipments for new public exchanges, as well as private plant equipments. The demand for its damp-proof mining instruments has also increased in the last few months.

A LOW-SPEED FAN.—A neat and novel idea in calendars has been developed by Mr. J. P. Williams, New York, general agent for the "Paragon" fan. On the card is a front view of a "Paragon" motor, provided with a movable four-blade cardboard fan. Each of the blades contains the calendars of three successive months. The fan, therefore, makes one revolution a year. But the genuine "Paragon" fan moves with considerable more alacrity.

THE STANDARD TELEPHONE & ELECTRIC COMPANY, Madison, Wis., states that since the general distribution of its very complete catalogue business has very materially improved. This company has closed during the last sixty days a number of contracts for exchange installations, and reports a steady and satisfactory business in all branches. It will shortly place on the market a complete line of switchboards, which will possess features of merit entirely new and of a character suited to the demands of the rapidly increased telephone business of the present day.

THE MILLER-KNOBLOCK COMPANY, South Bend, Ind., makes an offer to street railway men to ship an assembled commutator to fit any standard street railway motor, with the understanding that if it is not in every way acceptable it may be returned, free of cost both ways. The company claims that it has first-class facilities for producing these goods, and that it has never failed to make a permanent customer of a railroad company that obtained a sample commutator. Mr. A. W. Morrell gives his whole time and attention to the work, which is a guarantee that it is all right.

MR. CHARLES WIRT, 1028 Filbert Street, Philadelphia, Pa., has just shipped a large stock of Wirt dynamo brushes to Mr. Paul G. Fiedler, Kanagawa Electric Company, Tokio, Japan, who will hereafter supply that part of the world with Wirt brushes. Mr. Wirt reports the month of December, 1897, to have been a record breaker for business in his line. He has on hand a number of heavy stock orders from first-class electrical supply houses, and several from central stations. He has just issued a leaflet, in which is described and illustrated the Wirt field rheostat. These rheostats are made in fourteen sizes.

MECHANICAL DRAFT.—The subject of mechanical draft has been taken up and discussed from A to Z by the B. F. Sturtevant Company, Boston, Mass. The discussion is so complete and thorough that it fills a volume of 377 pages, leaving nothing that is at all relevant to the subject unfinished. The treatment begins with a chapter on Water, discussing its composition, weight and bulk, expansion by heat, etc., following this with similar chapters on Steam, Combustion, Fuels, Efficiency of Fuels and of Steam Boilers, Rate of Combustion, etc. This scientific work, including as it does, the results of many special tests and experiments, brings out radical departures in certain features of boiler practice, which, although recognized, have not as yet come into general adoption. Chief of these is the substitution of the fan for the chimney. In spite of the fact that the work is published by a company supplying apparatus, the correct and scientific principles on which the use of this apparatus is based has rendered the work of a rather impartial character, and made it easy to substantiate its statements by quotations from eminent authorities. The whole of the work is carefully illustrated with clear drawings and diagrams, such as to bring out more forcibly the truths indicated in the text. A careful reading is almost certain to result in the conversion of the reader to a belief in the superiority of mechanical draft.

Business Notice.

TO SUNNY CALIFORNIA every Saturday night during the winter months. Personally conducted tourist car excursions, organized by the Chicago, Milwaukee & St. Paul Railway, start from Chicago every Saturday at 10 o'clock P. M., and run through Omaha, Lincoln, Colorado Springs, and Salt Lake City to Sacramento, San Francisco and Los Angeles, via the popular midland tourist car route. Each car is accompanied by an intelligent and obliging courier, who makes himself useful to all the passengers. This is an entirely new departure in tourist car service, and is highly approved by hundreds of California passengers. A sleeping berth costs but $6, and the railroad ticket is proportionately cheap. Apply to the nearest coupon ticket agent for an illustrated time table folder of the midland route to California, or address E. F. Richardson, General Agent, Passenger Department, New York, for further information.

Illustrated Record of Electrical Patents

UNITED STATES PATENTS ISSUED DECEMBER 28, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

REISSUE.

11,645. SIGNALING CIRCUIT; J. J. O'Connell, Chicago, Ill. Original App. filed March 3, 1896. App. for reissue filed Oct. 20, 1897. In an electric circuit, the combination of a high resistance signaling instrument connected therewith, a signal current generator, a key or circuit changer controlling the said generator and adapted to connect it with the said circuit, an automatic locking device for the said key adapted to hold the same in operative position, means for strengthening the said signaling current after the signal has been received, consisting of a normally open branch circuit of relatively low resistance associated in parallel with the said signaling instrument and a switch for closing the same to reduce the circuit resistance, and a releasing electromagnet associated with the said key and adapted to unlock the same, the said magnet being irresponsive to the normal signaling current, but responsive to the same when strengthened by the closure of the low resistance branch.

596,054. ELECTRIC RAILWAY; E. C. Crocker, Bridgeport, Conn. App. filed April 23, 1897. In an electric railway system, which comprises a supply conductor, a third rail, consisting of insulated sections, and a power collector carried by the car, the two series of double wound magnets arranged in horizontally disposed couplets, the magnets of one series being connected in alternate airs in circuit, with pairs of alternate magnets of the other series, and connections with said conductor and sections through intermediate circuit closers and breakers operated by the magnets, whereby the section having contact with the collector is in closed circuit, while the sections immediately succeeding the preceding are in circuits capable of being closed by the collector.

596,085. ELECTRICAL SIGNAL BELL FOR STREET CARS; J. P. Orr, Pittsburg, and T. F. Galvin, McKeesport, Pa. App. filed Aug. 3, 1896. In an electric signal bell, the combination of a bell clapper and its arm, a ratchet wheel, having thereon anti-friction rollers adapted to engage the

bell clapper arm and an automatic circuit opener, with a lever attached to a vibrating armature, a pawl pivotally mounted on the end of the armature, which is adapted to engage and propel a second wheel.

596,131. TROLLEY; A. Travaglini, Philadelphia, Pa. App. filed Nov. 13, 1896. In combination with a trolley pole, a trolley wheel carried thereby, a fin adapted to be brought into vertical alignment with the wheel or removed therefrom, and means for automatically operating the fin.

596,134. SIGNALLING CIRCUIT FOR FIRE AND POLICE SYSTEMS; A. Barrett, Kansas City, Mo. App. filed Sept. 9, 1897. The combination in a common battery signaling system, of a circuit composed of two conductors extending through a plurality of sub-stations or street boxes normally open at each station, and terminating in a central station; means in each box operative upon the opening of its door for first, momentarily closing a circuit over one conductor of the main circuit through the earth to the central station; and second, means for intermittently closing and opening a circuit over the second conductor of the main line circuit and through the earth to the central station; and third, means for closing the said two conductors to include telephones with signal receivers at the central station in circuit with the first conductor consisting of visual and audible instruments, and signal receivers in circuit with the second conductor consisting of visual and recording instruments and means for connecting telephonic instruments between the said two conductors.

596,135. SECURING DEVICE FOR COVERS OF DYNAMO-ELECTRIC MACHINES; N. C. Bassett, Lynn, Mass. App. filed March 27, 1897. In a device for securing the cover of a dynamo-electric machine, the combination of a pivoted handle, a screw-threaded bolt upon which the handle is pivoted, a cam on the handle engaging with the cover, and a lug on the under side of the handle engaging with a projection on the base to prevent it from turning.

596,136. ARMATURE WINDING AND COIL; A. F. Batchelder, Schenectady, N. Y. App. filed Sept. 15, 1897. A coil for a dynamo-electric armature, having the sides to be disposed on the armature face united at least at one end by three end portions, two of which are involutes offset from one another, and third a spiral.

596,152. DETACHABLE LAMINATED POLE PIECE FOR DYNAMO-ELECTRIC MACHINES; H. Geisenhoner, Schenectady, N. Y. App. filed Oct. 11, 1897. In a dynamo-electric machine the combination of a support provided with slots extending parallel to the shaft of the machine, laminated detachable pole pieces having projections inserted in the slots, and means for securing the pole pieces in place by expanding them at the point where they enter the slots.

596,160. ELECTRIC HEATER; H. Helberger, Munich, Germany. App. filed April 29, 1896. In an electric heater the combination with a body to be heated, said body being a conductor of electricity, of a wire surrounding the same, a series of beads of refractory material strung upon the wire and in contact with the body to be heated, and a layer of refractory material outside the beads.

596,162. THERMOMETER; L. E. Hunt, Somerset, Ky. App. filed Sept. 21, 1896. The combination with a thermometer, of an electrical connector extending into the mercury at the bottom of the same, a cap adapted to fit over and close the upper end of said thermometer and having a screw-threaded split contracting stud, a screw-threaded nut or cap mounted on the split stud and provided with a central aperture, a packing interposed between the top of the stud and under side of the nut or cap, and a contracting rod passing through the split stud and the nut or cap so as to enter the thermometer; the construction being such that the nut or cap jams the split nut and packing against the contacting rod and thus holds it in its adjusted position.

596,182. ELECTRIC RAILWAY; W. B. POTTER, Schenectady, N. Y. App. filed Nov. 18, 1896. In an electric railway, the combination of a third or main working conductor connected with a source of supply, the continuity of which is interrupted at predetermined points, a conductor section located between adjacent ends of the main working conductor and insulated therefrom, a moving vehicle, a contact shoe carried by the vehicle arranged to complete the circuit between the conductor section and the source of supply, and means located in any convenient place, for controlling the current supplied to the conductor section, irrespective of the operation of the vehicle.

596,186. PHASE REGULATOR; C. P. Steinmetz, Lynn, and E. W. Rice, Jr., Swampscott, Mass. App. filed Sept. 9, 1893. The method of controlling the phase relation between current and E. M. F. in an alternating-current circuit, which consists in revolving a closed secondary conductor relatively to its primary conductor at a rate above or below synchronism, according as an acceleration or retardation of the current relatively to the E. M. F. is desired, and varying the self induction of such secondary member to modify the accelerating or retarding influence thereby secured upon the phase relation of the main current.

596,190. INDUCTION WATTMETER; E. Thomson, Swampscott, and W. H. Pratt, Lynn, Mass. App. filed Sept. 7, 1897. In an electric meter the combination of a field-magnet structure forming a closed iron frame with poles for the current and potential fluxes at points 90 degrees apart, a cylindrical armature, and a magnet structure within the armature whose magnetic circuit is completed through certain of the poles on the external frame.

596,193. TROLLEY BASE CUSHION; W. G. Wagenhals, Dayton, Ohio. App. filed July 23, 1897. In an electrically propelled railway car, an elastic or yielding cushion consisting of a base plate secured to the roof of said car; two pairs of helical springs mounted on said base plate; and means for securing said springs to said base plate, in combination with a trolley having a base mounted on and above said springs.

596,197. ELECTRICAL PROTECTIVE APPLIANCE; A. S. Williams, Newton, Mass. App. filed Aug. 26, 1897. In an induction coil or electromagnectic appliance the combination with the fine-wire winding thereof, and an associated protective appliance, consisting of circuit-changing contact points and springs, a protective or alarm circuit controlled thereby, and a rod or mass of easily fusible material solid at normal temperature, but fusing or softening under a moderate advance, supported by the said winding and normally maintaining the said circuit-changing springs in their inoperative position, a sheet metal heat collecting screen interposed between the said winding and the said easily fusible mass, and nearly eneveloping the former.

596,201. ELECTRICAL SIGNALING SYSTEM; J. P. Buchanan, Boston, Mass. App. filed Dec. 27, 1893. In an electrical signaling system the combination of electric conductors arranged in multiple-arc circuits, each of said arc circuits including an electromagnet and all of said arc circuits including a common generator, the magnets being arranged in the same direction from said generator along a railway track, and circuit controllers operated by said magnets and signaling mechanism operated or controlled by said circuit controllers, said arc circuits adapted to be operated in succession by a passing train and so arranged that when a train operates the first arc circuit the circuit controller therefor is affected, but not the other circuit controller, and when the train operates the succeeding arc circuit both circuit controllers are affected.

596,202. RAIL BOND; E. H. Daniels, Worcester, Mass. App. filed July 26, 1897. As a improved article of manufacture, a rail bond comprising a rod, each end of which is reduced and provided with a tubular terminal, the portion of the rod adjacent to the terminal being provided with a longitudinal depression forming a semi-tubular portion in alignment with the tubular terminal, and an annular flange or shoulder between the tubular and semi-tubular portions.

596,209. REMOVABLE FUSE HOLDER; J. T. Hunt, New York, N. Y. App. filed July 12, 1897. A fuse holder comprising portions each of non-conducting material, one portion having end extensions and a plate and the other portion corresponding substantially in outline with and being covered by said plate and having end recesses receiving said extensions combined with means securing said portions together to from the body or block, plates at the ends of said body, screws fastening said plates to said body, fuses connecting said plates at opposite sides of said body, and the posts for said plates.

596,226. ELECTRIC SIGNALING SYSTEM; A. J. Wilson, Portchester, N. Y. App. filed Dec. 21, 1895. In an electric signaling system for railways, the combination of a track divided into blocks, home and distant signals normally at "danger" for the blocks, a home signal and a distant signal being located at the entrance of each block, each home and distant signal having a separate motor peculiar to itself, normally de-energized signal circuits for the signals and normally closed circuits controlled by a train for energizing and de-energizing the signal circuits to operate the signals, the arrangement being such that a home and distant signal may be put to "safety" by a train in the rear of the signals, both of said signals may be put to "danger" by a train in the block guarded by the home signal, and the distant signal may be also put to "danger" by a train in the block in advance of the block guarded by said home signal.

596,224. TROLLEY RAIL; W. A. P. Willard, Jr., Hull, Mass. App. filed Feb. 12, 1897. In a trolley rail mechanism, a conductor and a truck normally out of electric contact therewith, and adapted to have a limited longitudinal movement in either direction into electrical contact with said conductor, said truck being mounted upon rolls and capable of movement upon the contact therewith of a contact shoe.

596,225. TROLLEY RAIL FOR ELECTRIC ROADS; W. A. P. Willard, Jr., Hull, Mass. App. filed March 6, 1897. A trolley rail mechanism, consisting of a contact rail suitably supported and capable of traveling longitudinally and an electric conductor, normally insulated therefrom, and means whereby when said rail travels longitudinally, electric contact will be established between the said contact rail and said conductor.

596,229. UNDERGROUND JUNCTION BOX FOR ELECTRIC CONDUCTORS; W. F. Bossert, Utica, N. Y. App. filed Feb. 17, 1897. An insulating stuffing box, consisting of a body portion, an insulator bushing held therein, a cap, an insulator bushing held therein and an elastic packing between the adjacent ends of the bushings.

596,236. ELECTRIC GAS LIGHTING DEVICE; A. L. Bogart, New York, N. Y., and LeR. S. White, Waterbury, Conn. App. filed May 7, 1897. In an electric gas lighting and extinguishing device, a burner, a gas supply, controlling valve provided with a stem, an armature secured to the said stem, an electromagnet for actuating the armature to open and close the valve, an igniting tube, an auxiliary gas-supply controlling valve therefor, the said auxiliary valve being located in position to be engaged and opened by the said armature when the electromagnet is energized and a sparking device under the control of the movement of the auxiliary valve.

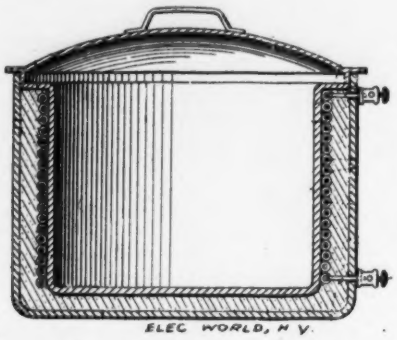
596,250. FIRE TELEGRAPH REPEATER; F. A. Skelton, Newton, Mass. App. filed July 3, 1893. In a repeater for use with a series of circuits extending from a central station, the combination with magnets for the respective circuits of mechanism controlled by each of the magnets for releasing a clock train, switching and locking devices controlled by the said train for locking the inactive magnets and switching the inactive circuits onto a signaling contact device while leaving the active magnet in its normal condition, a resetting device acting at each impulse of the signal to restore the armature of the active magnet and an additional mechanical resetting device connected to the operating train in such relation to the main resetting device as to operate subsequently thereto and lock the said armature after it has been reset until the circuit through said active magnet is complete.

596,272. ELECTRIC BICYCLE; H. W. Libbey, Boston, Mass. App. filed Nov. 8, 1895. In a bicycle, the combination, with a frame of an electric battery and motor thereon, said motor comprising a series of straight, parallel, central permanent field magnets, having their poles arranged alternately with each other, a shaft having its axis concentric with the magnets, a plate upon the shaft on each side of the magnets, a series of armatures for each plate, each series of armatures consisting of a pair of horse-shoe magnets passed through and insulated from the plates, a coil upon the inner end of each of the horse-shoe magnets, a commutator for each series of armatures, the brush of each of which engages with the central magnets and means for transmitting the motion of the motor to the driving wheel.

596,273. ELECTRIC BICYCLE; H. W. Libbey, Boston, Mass. App. filed Dec. 14. 1895. In a bicycle, the combination, with a frame, a portion of which is bifurcated, of an electric battery upon the bifurcation, a motor upon each side of the bifurcation of the frame, an axle in said bifurcated portion common to both of said motors, and a bifurcated pitman connecting the said crank shaft with the driving wheel.

596,274. ELECTRIC BICYCLE; H. W. Libbey, Boston, Mass. App. filed Dec. 14, 1895. In a bicycle, the combination, with a frame, provided with a vertical rear fork, of a double motor upon the fork, means for communicating motion from either one or both of the motors to the driving wheels, a double electrical battery upon the frame, and means for communicating energy from either of the motors to the driving wheel of the bicycle in a line with the rear fork.

596,276. TELEPHONING FROM CARS IN MOTION; H. W. Libbey, Boston, Mass. App. filed April 6, 1897. In a railroad, a wheel having a ring of conducting material let into the edge of its flange, but insulated therefrom, and a ring of conducting material attached to the inner side of the flange, but insulated therefrom.



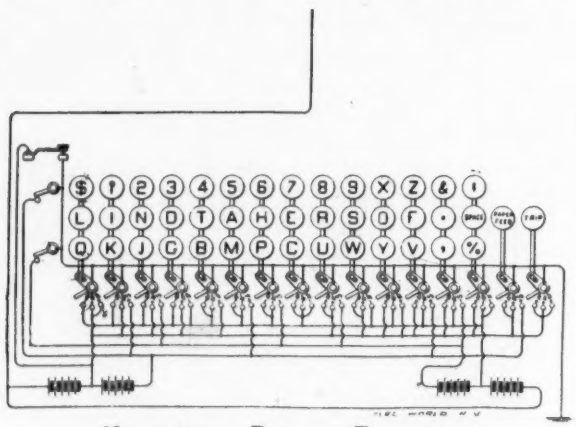
No. 596,160.—Electric Heater.

596,280. FOUNDATION FOR GENERATOR FRAMES; S. H. Short, Cleveland, Ohio. App. filed March 13, 1897. A foundation, provided with a suitable pit, suitable tops placed upon opposite sides of the foundation, plates or castings provided with suitable notches or recesses in their under sides, and the flanges at their top edges, and the adjusting screw to pass through one of said flanges, combined with the generator frame, thin sheets of iron placed between the frame and the plates and the foundation bolts which are passed through the generator frame, the plates and the foundation wall, whereby the parts are secured rigidly in position.

596,283. ELECTRIC CURRENT METER; R. P. Wilson, London, England. App. filed March 24, 1897. In combination with an electricity meter, adapted to register the amount of electric current used at different periods of the day, a switch and a clock mechanism for operating the same, said switch having circuit-closing devices, which are adjustable, and are adapted to be set to act at any desired period of the day, and an indicating device, showing the rate at which the meter is registering at any given time.

596,306. DYNAMO-ELECTRIC MACHINE; P. W. Power, Pittsfield, Mass. App. filed Feb. 12, 1896. In a dynamo-electric machine, having a rotating inductor, laminated polar projections, separately fastened to the inductor core by dovetail fastenings.

596,320. PRINTING TELEGRAPH; B. A. Brooks, Brooklyn, N. Y. App. filed Aug. 11, 1894. In a printing telegraph, the combination of a line wire and electric switches, connected in series in said line, and means for sending a characterized succession of impulses over said line and through said switches successively, whereby a final impulse is transmitted directly to a magnet controlling the corresponding printing mechanism.



No. 596,320.—Printing Telegraph.

596,356. ELECTRIC CALL BOX SYSTEM; W. T. Budds, Charleston, S. C. App. filed July 14, 1897. An electric call box, comprising a motor, a circuit-controlling wheel operated by the motor, a segmental block of insulating material on one side of the wheel, a metallic plate on the block and insulated from the body of the wheel, brushes normally resting on the plate and having connection with line wires, and a ground wire having connection with the body portion of the wheel.

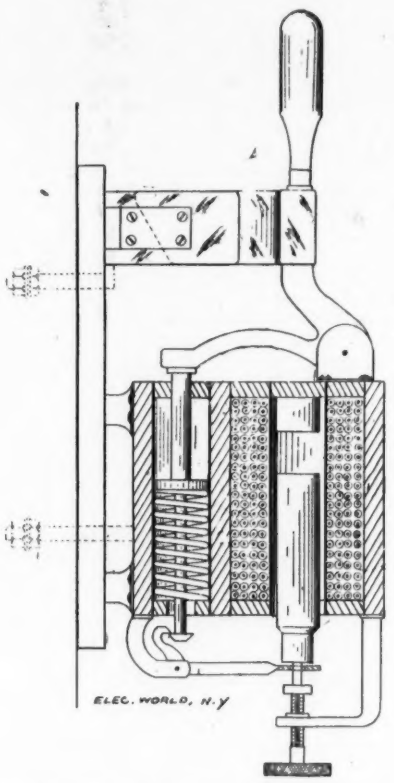
596,363. QUICK BREAK SWITCH; R. C. Demary, Buffalo, N. Y. App. filed Aug. 2, 1897. In a switch or circuit breaker, the combination of a base, circuit terminals mounted thereon, a switch blade pivotally secured to one of the terminals and co-operating with the other, a handle pivoted to the first-named terminal and movable independently of the switch blade, a spring connection between the switch blade and the handle, a locking lever pivotally secured to the switch base and swinging in a plane at right angles to the switch blade, a catch projecting from the latter and designed to engage with said locking lever, to hold the blade against the action of the spring while the switch handle is partially moved, and means for releasing the switch blade from the locking lever when the maximum tension of the spring is obtained.

596,418. MAGNETIC ELECTRIC SIGNALING APPARATUS; A. S. Williams, Newton, Mass. App. filed June 5, 1897. In a telephone signaling apparatus, and in combination with the field magnet and armature thereof; a key or press button and a motor spring adapted to successively move the said armature in opposite directions, respectively, and a detaining device controlling and acting to delay the operation of said spring, and itself controlled by the said press button.

596,426. ANNUNCIATOR. A. D. Neale, Kittanning, Pa. App. filed March 17, 1897. An improved annunciator, including a vibratory support, a call indicator adapted to move in a plane transverse the line of vibration of the support, and formed with a notched opening, the edges of the said indicator being inclined toward the entrance to said opening to guide the support thereinto when setting the indicator.

596,439. TAKE UP FOR CONTROLLING SLACK OF TROLLEY ROPES; H. E. Adt, New Haven, Conn. App. filed May 10, 1897. In a take-up device for controlling the slack of trolley ropes, the combination with two spool-frame brackets, permanently located upon the ends of a trolley car, of a two-armed spool frame adapted to be detachably connected with either one of the said brackets, according to the direction in which the car is to be run, a non-rotatable spool shaft mounted in the arms of the said frame, and formed with a longitudinal slot, a chambered spool mounted upon the said shaft so as to rotate thereupon and adapted to have the lower end of a trolley rope attached to it, a spring located within the chamber of the spool, and encircling the said spool shaft, a collar located in the inner end of the said chamber, having the inner end of the spring connected with it, and mounted upon the inner end of the shaft upon which it has lateral, but not rotary movement, and a removable disc-shaped plate secured to the outer end of the spool, affording a bearing for the outer end of the shaft, and having the outer end of the spring connected with it.

596,456. TROLLEY FOR ELECTRIC RAILWAY CARS; E. Cone, Chicago, Ill. App. filed Dec. 11, 1896. The combination of a trolley pole provided with a rotatable trolley wheel at the upper end thereof, substantially V-shaped guards at each side of the trolley wheel and means for holding one of the wings of the substantially V-shaped guards in substantially vertical position, above the surface of the trolley wheel.



No. 596,457.—Combined Manual and Automatic Switch.

596,457. COMBINED MANUAL AND AUTOMATIC SWITCH; R. L. Hailey, New York, N. Y. App. filed Sept. 27, 1897. A combined manually operated switch and automatic circuit breaker, comprising a spring-actuated member, adapted when it is released to throw a switch, an electro-magnetic releasing device having connection to the spring actuated member and adapted to release the same at a predetermined pressure of current, and a switch to be thrown by the said released spring-actuated member that is located above the electro-mechanical apparatus, and that is adapted to be freely moved by hand to open and close the circuit without tripping, releasing or making operative the said electro-mechanical apparatus.